The Effects of the Listener Emersion Intervention on Rate of Learning and Increases in the Naming Capability in Preschool Children with Developmental Delays

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ABSTRACT

The Effects of the Listener Emersion Intervention on Rate of Learning and Increases in the Naming Capability for Preschool Children with Developmental Delays

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I tested the effects of the listener emersion protocol on rate of learning across academic instruction and the emergence of Naming. In two experiments, using a delayed multiple probe design, I first tested the effects of the listener protocol and then tested for the emergence of the listener and speaker components for Naming. In Experiment I, the participants were three preschoolers with developmental delays who had a limited repertoire of listener skills and had difficulty meeting their instructional objectives. None of them emitted a selection or listener response following mastery of match-to-sample responses for visual stimuli while hearing the word for the stimuli they matched during the listener half of Naming probes. Prior to the onset of the listener emersion training, participants' academic curricula were suspended and they were immersed in learning instructional sets of listener responses. The instructional procedure required the participants to respond only to the auditory properties (speech sound combination) of speech presented to them face-to-face, as well as to voices recorded on tape. This was done until the participants acquired both accuracy and rate of responding criteria for all the sets of the listener emersion protocol. Results from this experiment showed that mastery of the listener emersion protocol accelerated participants' rate of learning (decreased their learn units-to-criteria) to meet instructional objectives. The listener half of Naming emerged for two out of the three participants. In Experiment II, the listener

emersion protocol was used to test for the emergence of the speaker and the listener component of Naming for four preschoolers who had more vocal verbal behavior and faster rates of learning than the first group of participants. An additional novel set (two-dimensional stimuli) was used to test for the emergence of Naming. Results from Experiment II showed that the listener emersion protocol was effective in increasing the rate of learning for all participants. In addition, the listener and speaker halves of Naming emerged for two of the four participants.

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"If patience is worth anything, it must endure to the end of time. And a living faith will last in the midst of the blackest storm"

Mahatma Gandhi

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DEDICATION

I dedicate this to all the beautiful and beloved children I have had the amazing opportunity to work with.

Chapter I

INTRODUCTIONAND REVIEW OF THE LITERATURE

There are numerous theories of language acquisition. Despite the conflicting views, there is some agreement that the ability to successfully differentiate between speech sounds is the foundation for how typically developing children acquire language. For instance, auditory discriminations of speech sounds (e.g."pa" versus "ba") begin to appear in developing babies as early as four weeks old and become increasingly more refined with subsequent months (Cyrstal, 2006; Greer & Ross 2008; Haynes & Shulman 1994).

A progression of theoretical and conceptual research in the behavior analytic field (Barnes-Holmes, Barnes-Holmes, & Cullinan, 1990; Greer, Chavez-Brown, Nirgudkar, Stolfi & Rivera-Valdes, 2005; Feliciano, 2006; Greer & Ross, 2008; Greer & Speckman, 2009; Horne & Lowe, 1996; Skinner 1957, 1989; Stemmer 1990) has focused on the increasing importance of the role of the listener and fluent listener repertoires. Researchers concur that for children who lack the acquisition of true listener behavior, the important developmental connection between a listener and speaker repertoire may fail to develop. This possible disconnect between listener and speaker behaviors thus raises the important question of the role that is played by a fluent listener repertoire in the development of more complex verbal behavior such as the induction of Naming. Naming, in the behavior analytic literature, is defined as a behavior developmental change that allows children to acquire language incidentally (Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009; Horne & Lowe, 1996).

The first study that empirically demonstrated the effects of a procedure defined as

the listener emersion protocol on the acquisition of fluent listener responses in children with autism who had limited listener repertoires was implemented by researchers Greer, Chavez-Brown, et al. (2005). The results from their study were important because they showed that the listener emersion intervention resulted in the participants acquiring listener literacy, a preverbal developmental cusp that facilitated in increasing the participants' rate of learning. These results then led Greer, Chavez-Brown et al. (2005) to hypothesize that, "complex repertoires such as the development of the listener component of Naming and the speaker component of Naming is not possible without basic listener literacy" (p. 17). This unanswered question made it necessary to further examine the importance of listener literacy as the foundation for Naming.

Feliciano's (2006) study using multiple exemplar instruction tested for the emergence of the listener half of Naming in children who were missing this repertoire. Her study showed that the instructional intervention resulted in the children acquiring the listener half of Naming. In a later study, Speckman-Collins Lee-Park, and Greer (2007) tested the effects of an auditory match-to-sample protocol on the emergence of the listener component of Naming. They found that the interventional procedure resulted in the children acquiring the listener component of Naming. Both studies tested two different protocols to look at other possible instructional histories in the induction of Naming. The results from these studies stressed the importance of the role of the listener, but also provided a theoretical and empirical basis for testing more *environmental interventions* that can be functionally linked in the induction of verbal behavior, such as Naming for children with developmental disabilities and language delays. To date, no research has been conducted using the listener emersion protocol as a possible effective

intervention in the induction of Naming.

The purpose of my research was to further expand upon the hypothesis put forward by Greer, Chavez-Brown et al.'s (2005) basic listener literacy study. The research question I formed is as follows. In relation to the emergence of a more complex repertoire, does the emergence of listener emersion protocol provide an instructional history that results in the listener and speaker components of Naming? The aim of my study was also to look at the effects of the listener emersion protocol on increased rate of learning.

In the following sections, I will examine the relevant literature that supports my current experiments. I will start by examining the different theories of how language evolved. Following this, I will summarize Skinner's analysis of language as verbal behavior, as well as other investigator's of related theories of how language is developed based on Skinner's verbal behavior framework; Theories such as Stimulus Equivalence, Relational Frame, Naming, and the Verbal Behavior Development Theory. Next, I will examine the developmental sequence of preverbal cusps such as listening to adult voices as conditioned reinforcer for listening and its relation in the acquisition of listener behavior. Following this, I will also summarize empirical research within the behavior analytic field involving different environmental interventions in the induction of Naming. Finally, I will summarize theoretical and empirical work related to the role of the listener, acquisition of a fluent listener repertoire and its importance in the induction of Naming. (Due to the scientific terminology used in the field of verbal behavior, brief definitions of these terms are provided in Appendix A.)

Literature Review

Theories of How Language Evolved

Proponents of different theories of language have, over the years, undertaken the task to identify and provide different accounts of how language evolved. In providing a behavioral account of how language works, Skinner, (1957) in *Verbal Behavior,* provided a theoretical perspective on the development of language or verbal behavior by suggesting that language is developed and reinforced by a verbal community (the listener). Skinner (1957) thus defined verbal behavior as "behavior reinforced through the mediation of other persons" (p. 2). On the evolution of language, behaviorist Catania (1998) has also suggested that communicative language emerged through cultural selection. Catania (1998) defined cultural selection as "the selection of behavior as it is passed on from one organism to another" (p. 385) further positing that, in accordance to the cultural selection theory, learned behavior is culturally transmitted from one generation to the next.

Early on, linguistic theorist Noam Chomsky (1959), in a refutation of Skinner's *Verbal Behavior* (1957), proposed that language is too complex and "reinforcement cannot account for language acquisition" (as cited in Hayes & Chase, 1991; p.110). Chomsky's central argument was that, during their developmental years, children are exposed to thousands of words and grammatical rules (syntax, words, meanings) in their environment and that it is impossible for them to master these words and rules through direct instruction (Kenneally, 2007). Chomsky referred to this as the "poverty of stimulus" (Greer, 2008) phenomenon. He goes on to assert that a child learns to acquire the rules and structure of language through a genetically determined innate mechanism

called *universal grammar* (UG), which Chomsky claimed underlies all languages. According to his universal grammar theory, there is a language organ that is "hardwired into people's brain" that governs a child's ability to learn the correct grammar of each language (Everett, 2012; Kenneally, 2007).

In contrast to the Chomskyan theory, linguist Lieberman (1984) argued in his book, *The Biology and Evolution of Language*, that the foundation for language ability occurred with the evolution of the human brain over time, resulting in the development of coordination between motor abilities and anatomical changes. For example, in humans the descent of the larynx, and the physiology of the baby's tongue begin to occur during infancy and provide the necessary physical changes in the development of the infant's speech (Holden, 2004; Kenneally, 2007, Lieberman, 1984). Research in language development has shown that by the age of 15 months, infants begin to move from babbling to speaking and their average vocabulary doubles from 41 to 81 words between 17 and 19 months old (Hart & Risley, 1999; Pinker 1999).

Similar to the behavioral perspective, anthropologist Deacon (1997) asserts that the evolution of language has a social beginning, which is linked to the establishment of a social system. According to Deacon (1997) the ability of humans to learn symbolic reference is what formed the basis for the evolution of language and the human brain. He goes on to explain that this symbolic language did not just emerge from the brain but coevolved as a result of both genetic and environmental changes. Dunbar (1990, 1993) has also stressed this connection. He proposed that the cognitive demands of maintaining the complexity of social relations led to the evolution of language, further confirming Skinner's (1957) position that verbal behavior is essentially social behavior.

Verbal Behavior Theories

Since the publication of Skinner's (1957) theory of verbal behavior, research based on his work has led to the emergence of new theories of how language develops from a behavioral perspective. Such theories include research in stimulus equivalence (Sidman, 1986, 1994), the Relational Frame Theory (Hayes, Barnes-Homes, and Roche; Hayes et al., 2001), Naming (Horne & Lowe, 1996), and the Verbal Behavior Development Theory (Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009). These theories have provided an empirical account of verbal development based on experimental analyses rather than correlations with age (Greer, 2008).

Skinner's Theory

Skinner's theory (1957) provided a functional account of the origin of language. He viewed the development of language as operant behavior. Thus, as a result of operant conditioning, "a child acquires verbal behavior when relatively unpatterned vocalizations, selectively reinforced, gradually assume forms which produce appropriate consequences in a given verbal community" (Skinner, 1957, p. 31). This theoretical approach to defining verbal behavior as operant behavior was a direct product of his research with using what he referred to as the three-term contingency, consisting of the antecedent stimuli, the behavioral unit being the response, and its consequence in a specified situation (antecedent-behavior-consequence) (Cooper, et al., 2007; O'Donohue & Ferguson 2001; Skinner, 1957).

Examining the development of language from a functional perspective, Skinner (1957) identified six types of functional relations between controlling variables and

verbal responses. He named these verbal units as echoic, mand, tact, intraverbal, textual, and autoclitics (Skinner 1957). He characterized the acquisition of these verbal operants not by their genetic origins, but on the basis of environmental contingencies (Greer & Ross 2004).

Williams and Greer (1993) carried out a study to demonstrate the efficiency of using a verbal behavior-based curriculum versus a linguistic-based curriculum (Guess, Sailor, & Baer, 1976) on the acquisition of incidental language for children with limited vocal verbal repertoires. Using the same operant teaching procedures, training of mands under the linguistic curriculum consisted of presenting a vocal verbal antecedent "What do you want?" The training of tacts consisted of presenting a verbal antecedent, such as "What is this?" Under the behavioral-based curriculum, the children were not presented with any vocal antecedent, but given opportunities to mand by creating a state of deprivation. Correct responses were reinforced by the item/activity manded. Similarly, correct tacts were reinforced by praise and opportunities to mand. The results of the study showed that the students who learned to respond under the linguistic-based training procedure did not respond under the absence of the verbal stimulus; whereas, the children who received the verbal-based training were able to acquire mands, and tacts without any verbal prompts and were able to successfully maintain and generalize these verbal skills spontaneously. These results demonstrated that although the same procedures were used to teach both verbal and linguistic units, only Skinner's class of verbal operants were shown to be "natural fractures of language function" (Greer, 2002, p. 2).

Stimulus Equivalence Theory

According to Sidman's Stimulus Equivalence Theory (SE), (1971, 1982, 1990, 1994), the formation of equivalence relations is seen as a prerequisite for language, where the formation of bi-directional responses (symmetry) are biologically "given," and cannot be derived from some other behavioral process or basic principle. According to this theory, stimulus equivalence involves reflexivity, which entails identity matching of a stimulus to its self (A=A, B=B); symmetry which involves an interchangeable relation between the comparison and the sample stimulus (A=B, B=A), and by directly teaching frames (A=B, B=C), untaught emergent relation transivity emerges (A=B, B=C, A=C) For example, after extensively teaching youth with developmental disorders and limited language skills, Sidman (1971) and his colleagues (Sidman & Cresson, 1973), discovered that by using a match-to-sample (MTS) training to first select a picture of a car when paired with the vocal prompt "car," followed by teaching them to select the printed word "car" upon hearing the spoken word "car." The participants learned to select the corresponding picture of a "car" when presented with the written word "car," and when presented with the picture of a car, they selected the written word "car." That is, an untrained relationship emerged between matching printed words to pictures and pictures to words, without any direct training and any prior history of reinforcement. Following the establishment of these emergent relations, Sidman termed these novel emergent relations as *equivalence relations* and concluded that the results showed that stimulus equivalence had been established between the three stimulus members of each class: auditory name stimulus (car); the corresponding printed word (car); and the corresponding picture (car). Describing these behavioral outcomes of match-to-sample as

stimulus equivalence facilitated a behavioral model for explaining the nature of human verbal behavior that went beyond the traditional perspective (Horne & Lowe, 1996; LeBlanc, Miguel, Cumming, Goldsmith, & Carr, 2003, Rehfeldt & Barnes-Holmes 2009). According to Stromer, Mackay, and Remington (1996), Sidman's work served not only as the impetus for many of the verbal behavior studies that have since followed within behavior analysis, but has also generated questions regarding the origin of derived relational responding (novel) and its correlation with verbal behavior.

Relational Frame Theory

Hayes, Barnes-Homes, and Roche (2001) proposed a behavior analytic account of human language and cognition in terms of a theory called Relational Frame Theory (RFT). According to RFT, relational responding or higher order operants are established as a result of multiple exemplar experiences/instruction. RFT acknowledges that relational responding of young learners should be established in the early years by teaching them to discriminate between the relevant and the irrelevant features of the task. That is, children can be taught to respond to any task, when it is controlled by contextual cues and not bound by the physical form of the stimulus. In RFT, the responses based on contextual cues are established as a result of experiences with multiple exemplar instruction during language interactions between the child and his or her caregiver (Barnes, 1994; Rehfeldt & Barnes-Holmes 2009). For example, a child can be trained to respond to relations among events by teaching him to respond to questions such as "Which bag has a greater number of apples?" or "Which glass has a greater amount of milk?" Here the nonarbitary relation response "greater than," once taught, can be

arbitrarily applied, where as the *contextual cues* "greater than" will come to control the relational response and not the physical size of either the bag or the glass (Hayes & Wilson, 1996; Steele & Hayes, 1991).

Thus, as proposed by the Relational Frame theorists (Hayes et. al., 2001) and further described by Blackledge (2003), relational framing is seen as a process where individuals frame events relationally, following an extensive history of multiple exemplar instruction based on contextual cues, where novel stimuli may relate to other novel stimuli without direct instruction. Hayes and Hayes, (1989) and Hayes, Barnes-Holmes et al., (2001), posit that in the language developmental process Naming is viewed as the most important relational frame and is seen as the onset of being truly verbal.

In order to test for relational responding that results from relational frames, RFT relies on the three key processes of: 1) mutual entailment 2) combinatorial entailment, and 3) transfer of stimulus function (Hayes & Wilson, 1993, Hayes, Barnes-Holmes et al., 2001; Clayton & Hayes 1999).

Naming Theory

Horne and Lowe (1996) first identified Naming as the basic unit of verbal behavior that arises naturally in a child's language interactions around the age of two. In their conceptual paper, the authors point out that in *Verbal Behavior*, Skinner (1957) did not use Naming as a technical term to describe the functional analysis of verbal operants (specifically in regard to the tact operant), and acknowledged the behavior of the listener and the speaker as separate repertoires. Rather than contradicting this view, the researchers' aim was to establish Naming as a higher order bidirectional relation based on

a behavioral model.

According to this analysis, Naming is said to exist when children can respond to a stimulus as a listener and a speaker without direct instruction (Horne & Lowe 1996; Greer, Stolfi et al., 2005). Horne and Lowe (1996), proposed that the bidirectional Naming repertoire is initially established through reinforcement of listener behavior (orienting to the stimuli tacted or jointly observing the stimuli tacted), followed by reinforcement of hearing one's own echoic responding (speaker responds as a listener to his own speaking). Thus, Naming, as learned by a child, is a circular or closed-loop relationship that includes seeing an object, saying its name, hearing one's own utterance and seeing or attending to the object again. For example, a child sees a shoe, hears "shoe," echoes "shoe," and orients his/her head to make visual contact with the shoe again. Furthermore, the researchers explain that once a child learns to be a speaker-listener for one object (a particular shoe), the child is also able to name others (different kinds of shoes) in the same stimulus class to which he or she may have responded previously only as a listener. The authors conclude that in Naming, the bi-directional relation that combines the listener and speaker within the individual, once established, no longer requires reinforcement of both the listener and the speaker behavior separately in order for children to continue to acquire language incidentally.

Verbal Behavior Development Theory

Expanding on Skinner's (1957) analysis of verbal behavior and also guided by the research findings on Naming (Horne & Lowe, 1996) and Relational Frame Theory (Hayes & Hayes 1989; Hayes, Barnes-Homes, et al., 2001), research in Verbal Behavior

Development Theory (VBDT) led to experimentally identified protocols and the classification of a sequence of verbal developmental cusps or stages and in some cases verbal capabilities. They include: a pre-listener status (pre-verbal status); listener status; speaker status; speaker and listener exchanges; speaker as own listener status (Naming, self-talk and say/do correspondence); reader status; writer status; and finally, writer as own reader status (self-editing) (Greer & Keohane, 2005; Greer & Ross, 2008).

Using Rosales-Ruiz and Baer's (1996) definition, Greer (2008) defined developmental cusps as the acquisition of new operants, which are established as a result of environmental experiences that allow a child to come into contact with new environmental contingencies of reinforcers and punishers. For example, once a child has acquired basic listener literacy, acquisition of this repertoire is defined as a cusp and not a capability because, although the child begins to respond as a listener to the vowel consonant sounds of the speaker, the child does so from direct acting contingencies associated with his or her environment. However, when the acquisition of a cusp leads to a *new way* of learning that allows a child to acquire novel behaviors incidentally from the environment without any direct or prior reinforcement, the process is referred to as a verbal behavior developmental capability. For instance, Naming is one type of incidental learning capability that initially allows separate speaker and listener cusps that evolve within the same child to join, leading to the development of language (Greer & Longano, 2010; Greer & Speckman, 2009; Horne & Lowe, 1996; Skinner 1957).

Since its inception, Skinner's (1957) verbal behavior theory has provided an important foundation to analyze language scientifically. His theory has contributed to understanding and empirically testing the role of the listener and its interrelationship with

the speaker, leading to the emergence of novel verbal behavior. Therefore, if we are to understand the role of the listener as a prerequisite to Naming, it is necessary for us to first study the mechanics of how the development of the listener repertoire functions as a foundation for Naming.

Listener Behavior as a Foundation for Naming

Skinner (1957), in his examination of listener behavior and the importance of what role the listener repertoire plays in the acquisition of language or verbal behavior, suggested that it is important to first recognize that the speaker and the listener repertoires are not "a unitary psychological entity" with receptive and expressive characteristics, as described by some psycholinguists (Greer & Speckman, 2009, p. 1). Skinner believed that these were initially separate repertoires that evolve within an individual and eventually come to be joined, leading to listener-as-own-speaker within an individual, which he acknowledged to be the focal point of acquisition and emergence of complex verbal behavior. "We need separate but interlocking accounts of the behaviors of both the listener and the speaker if our explanation of verbal behavior is to be complete…in many important instances the listener is also behaving at the same time as a speaker" (Skinner, 1957, p. 34.)

This Skinnerian perspective on the development of verbal behavior paved the way for researchers in the behavior analytic field to become involved in examining the two repertoires separately, as well as researching the point in which they come to intercept leading to Naming. Naming (Greer, Stolfi, et al., 2005) and self-talk involving rotation of the listener and speaker in a spoken voice by young children (Lodhi & Greer, 1989), are

two of the three speaker-as-own-listener capabilities that have been established experimentally within the Verbal Behavior Development Paradigm.

While some behavioral researchers (Hayes & Hayes, 1989; Hayes & Wilson 1993; Horne & Lowe, 1996; Hayes, Barnes-Holmes, & Roche, 2001) believed that Skinner's account of verbal behavior (1957) did not lend much importance to the role of the listener, other behaviorists, such as Greer and Ross (2008), Greer and Speckman (2009), Schlinger (2008), and Stemmer (1996), stress that Skinner (1957) did not omit the listener. They posit that Skinner's functional perspective in describing language or verbal behavior took into account that language is shaped in individuals by their interaction with their audience (listener). In other words, the utility of verbal behavior for the listener is established by the verbal behavior emitted by a speaker. Therefore, if an individual (speaker) wants a glass of water, and the speaker says, "Can I have a glass of water, please?" the speaker's verbal behavior has an effect on the listener, who then hands a glass of water to the speaker. In another example, a speaker says, "What should I eat for breakfast?" This question results in evoking within the speaker a listener response, such as, "Maybe oatmeal." In this case, the speaker is simultaneously acting as his own listener. According to Cooper et al., (2007) this was Skinner's point: "The most significant and complex responses to verbal stimuli occur when they evoke covert intraverbal behavior from a listener who becomes a speaker and functions as her own audience" (p. 533). Thus, it is apparent that the listener is key in the evolution of verbal behavior.

Horne and Lowe (1996), in their examination of how Naming develops in children, proposed that before children learn to communicate, they learn the ability to

discriminate the speech of others. In other words, they learn to listen. Horne and Lowe (1996) go on to state that listener behavior is established from very early parent-child verbal and gestural interactions. For example, a child, upon hearing "Where is the shoe?" turns towards a shoe. Another example is when the parent instructs the child "give me the cup" and the child does so. Horne and Lowe (1996) thus perceived the listener behavior as a crucial prerequisite, without which the development of Naming is not achievable.

According to Horne and Lowe (1996), the circumstances that lead to the development of the listener behavior sequence occurs in the following manner: a) a child learns to discriminate the speech of others very early; b) caregivers observe what a child is looking at; c) caregivers then say the name of the object the child is looking at, pointing to the object, or indicating the object by other means such as rattling it, banging it and so on; d) after the child learns to point to objects, the caregivers reinforce the child's behavior of pointing to the object and her pointing to objects also becomes a stimulus discriminative for the caregivers to name the object. Put simply, during these adult-child interactions, the caregivers are directly reinforcing the child's listener behavior where through the process of operant conditioning listener behavior is acquired (Horne & Lowe, 1996).

Greer and Ross (2008), in their description of advanced verbal repertoires, posit that learning what role the listener plays in verbal behavior is crucial to understanding the development of complex verbal repertoires:

> "It is key not only for the child to have a listener who mediates the environment for her in the role of the speaker, but it is equally important for students to learn the role of the listener….a child who is not a listener is totally dependent on

others' assistance. In addition the self-editing or early stages of "thinking" are dependent on the listener function" (p. 68).

Within the VBD paradigm, initial research was carried out to induce the speaker repertoire in children who were missing this skill. However, the results of numerous studies conducted within the speaker domain also required the acquisition of a fluent listener repertoire eventually leading VBD theorists (Greer & Ross, 2008; Greer & Speckman, 2009, Greer & Longano, 2010) to examine the role of the listener as described by Skinner and its relation to language development. Thus the process of identifying and ameliorating deficits of the listener repertoire in children, resulted in the development of protocols to induce prerequisite developmental cusps that appeared to be crucial in sequentially progressing a child from a prelistener to a fluent listener (Greer and Ross 2008; Keohane, Pereira-Delgado, Greer, 2009). In order to further understand the importance of the role of the listener in the acquisition of Naming, it is important to discuss and take into account the key prelistener cusps as described by Greer and Ross (2008) as foundation for developing listener behavior.

Prelistener Cusps of Verbal Behavior for Developing Listener Behavior

Prelisteners are children with developmental delays who are missing certain prerequisite skills that are foundational to becoming fluent listeners. These children fail to develop the connection between what they hear and what they see, resulting in deficits in their listener behavior (Keohane, Pereira-Delgado, et al., 2009; Pereira-Delgado, Greer, Speckman & Goswami, 2009; Greer & Ross 2008). Greer and Keohane (2005) acknowledge that prelisteners learn to respond to commands through visual cues and are

fully dependent on the assistance of others (caregivers) for their day-to-day needs (Greer & Ross, 2008; Keohane, Pereira-Delgado et al., 2009). These prelistener cusps that have been empirically identified incorporate the following tested protocols (see Table 1) and support the VBD sequence of how children missing these skills achieve these verbal cusps, which are essential to becoming a listener.

Table 1

Prelistener: Pre- Verbal Developmental Cusps (Keohane, Pereira-Delgadoet. al., 2009)

Verbal Developmental Cusp	**Protocol**
Adult voices as conditioned reinforcers	Condition listening to adult voices
Conditioned reinforcement for visual stimuli 2D/3D	Conditioning visual stimuli as reinforcement for print and 3D
The capacity for sameness across the senses	Cross-modal sensory matching

Adult Voices as Conditioned Reinforcers

Conditioned reinforcement for adult voices has been described as being crucial in facilitating the development of the listener repertoire (Horne & Lowe, 1996; Greer & Ross 2008; Pelaez-Nogueras, Gerwitz, & Markham, 1996). Several studies on infant development of vocalizations (Decasper and Fifer 1980; Greer & Ross 2008; Palez-Nogueras, Gerwitz, & Marham, 2009) have theorized that for typically developing babies, conditioned reinforcement of auditory properties of speech of adult voices appears to begin developing before birth. In a typically developing baby, the process begins before birth, where the pairing of the mother's voice with in utero feedings leads to the mother's voice becoming a conditioned reinforcer for listening (Decasper &

Spence 1987; Greer & Speckman, 2009). Decasper and Fifer (1980) found that the rate of suckling responses of newborn infants on a non-nutritive nipple were observed to be higher when paired with the recordings of their mother's voices versus recordings of unknown female voices. This demonstrates that newborns recognize their mothers' voices soon after delivery. Once the infant is born, during the postnatal period as the infant's vision begins to develop, the mother's voice, which has acquired reinforcing properties, gets paired with other sensory experiences. As a result of these pairings, the infant's observing responses of looking at the mother's face, her touch, her smile, her smell, and tasting the mother's milk (Greer and Speckman, 2009), become conditioned reinforcers for the infant.

An early Ockleford, Layton, and Reader (1988), using eight-second recordings of speech and voices reading numbers for 24 infants ranging from birth to five days old, found that the infants' heart rates increased more in response to their mothers' voices than to a stranger's voice. The authors concluded that the mothers' voices, being repeatedly heard by the infants before birth, became familiar to the infants and resulted in them responding selectively by orienting to the mothers' voices after birth.

Tomasello and Farrar (1986), in a study of mother-infant dyad interactions with infant ages ranging from 6-8 months, found that when the mother provided the name of the item that the child was looking at or engaged in facilitated in the enhancement and development of an infant's listener behavior. Similar to the results in the above study, research conducted by Laakso, Poikkeus, Katajamaki, and Lyytinen (1999) of 111 mother-infant pairs, found a correlation between maternal interactional communications in the form of nonverbal gestures, affective encouragement, motivational strategies, and

joint attention strategies to higher developed verbal comprehension in children. Horne and Lowe (1996) have also suggested that in order to enhance a child's development of listener behavior, the caretaker's voice must function as an effective reinforcer for the child.

For children with developmental delays, these pairings may not have occurred automatically in utero, leading to inadequate development of acquiring conditioned reinforcement of adult voices. For these children, designing effective interventions that may facilitate in addressing deficits in conditioned reinforcement of adult voices is needed (Greer & Speckman, 2009)

Within the VBDT, empirical evidence from other studies has shown that the stimulus-stimulus pairing procedure has been an effective intervention in conditioning neutral stimuli as reinforcers. For example, the stimulus-stimulus pairing procedure has been successfully implemented to condition and induce other preverbal foundational observing responses: conditioned reinforcement for observing faces (Maffei-Lewis, 2011), conditioning visual stimuli as reinforcement for observing print (Pereira-Delgado, Speckman, et al. 2009), and conditioning tracking 2-D stimuli (Keohane, Greer& Ackerman 2006; Keohane, Luke, & Greer, 2008).

Greer, Pistoljevic, Cahill, and Du (2011) examined in children with developmental delays the effects of a voice conditioning protocol on increased rate of acquisition of listener responses, general awareness of adults and preferences for listening to stories recited by adults. The participants were three preschool students for whom adult voices did not function as conditioned reinforcers for listening. Adult voices were conditioned using a stimulus-stimulus pairing procedure until listening to audio

recordings of various adult voices telling stories functioned as reinforcement for listening. Results showed that after voices became conditioned reinforcers, the rate of acquisition of objectives across listener programs significantly increased for all three students. For two of the three students, the number of observing responses (awareness or presence of adults and attending to adult voices) across a free-play setting, one-to-one setting, and in a group setting also increased. For two of the three students preference in listening to adults reading stories in the free play setting increased and emission of stereotypy decreased. The results of their study showed that implementation of the conditioning voices protocol demonstrated a functional relation between the independent variable and the dependent variables. Thus, this study demonstrates that acquisition of conditioning reinforcement for voices is a key prerequisite cusp required in the development of listener behavior.

Once children acquire adult voices (auditory stimuli) as conditioned reinforcement for listening this serves as a platform to begin to discriminate between words that are identical or different. To induce this stage of verbal development, arranging training using the auditory matching protocol has been shown to successfully facilitate in the teaching and development of listener skills or phonemic control (Greer and Speckman, 2009).

Conditioned Reinforcement of Listener Responses through Auditory Matching

Chavez-Brown (2005) was the first to test the effects of the auditory matching protocol on the emergence of partial and full echoic responses for six participants. Data showed that prior to the onset of the study, participants who were missing an echoic

repertoire began emitting partial and full echoics following mastery of each of the training phases of the intervention.

More recently, Choi (2011) investigated and found that mastery of the auditory word match-to-sample repertoire resulted in participants' acquisition of echoics, listener literacy, Naming, and speaker-as-own-listener cusps. Additionally, in the second experiment, the effects of the auditory matching intervention also resulted in conditioning preference for listening to adult voices for all participants. The intervention consisted of an auditory MTS instructional program on a computer screen that displayed a button (target sound) on the top part of the screen and two buttons (one corresponding to the target sound/non target sound) at the bottom part of the screen. During the training phases, the participants learned to auditorily discriminate and match-to-acquisition a series of words and a series of phrases in progressive complexity. Prior to the onset of the study, probes were conducted that showed the participants were missing the emission of full echoics, the listener and speaker halves of Naming, listener literacy, and voices as conditioned reinforcers.

The data from the Chavez-Brown (2005) study and the Choi (2011) study explained in the above section, suggest how following the intervention, the auditory discrimination procedure had functioned to condition listener discrimination. Greer and Keohane (2005) emphasized that when children learn to discriminate between sounds and words, the onset of this stage serves as an important precursor in the acquisition of speaker behavior and in the emergence of more advanced listener behavior.

The Importance of Listener Literacy

Evidence from research studies in the behavior analytic field has suggested that in children who have severe language delays, the listener repertoire is one of the foundational repertoires identified for acquiring language. In order to discuss the importance of acquiring listener literacy as the foundational cusp to becoming a literate listener, we need to first define what Greer and Ross (2008) meant by listener literacy. According to them, listener literacy is defined as "the ability to be governed by the speech of others" (p.118). In other words, children learn to respond differentially to different speech sound combinations within a verbal community. For example, when a child is presented with the vocal direction "sit down," or "come here," or "put away," the child, by being under the spoken auditory antecedent delivered by another, can discriminate between these directions and can independently emit the target response.

According to Greer, Chavez-Brown, et al. (2005) and Greer and Ross (2008), mastery of instructional compliance by children with autism and other developmental disabilities does not assure acquisition of a basic listener repertoire, as these children learn to emit listener responses by relying heavily on visual cues rather than true auditory stimulus control. For instance, deficits in listener literacy have been linked to incorrectly emitting simple directions, such as when a teacher presents the vocal direction "clap hands," to a child, but the child stands up instead. Or, during a match-to-sample program (visual-visual discrimination), the teacher says "match car with car," but instead the child points to the picture of the car from an array of two other pictures.

Greer and Ross (2008) go on to posit that because the child fails to discriminate the vocal instructions presented by the teacher, the child may eventually go on to

demonstrate a correct response as a result of repeated instructions, which facilitates in simply teaching the child how to get better at acquiring visual cues. Greer and Ross (2008) acknowledge that tracking the teacher's eye movement as the teacher delivers a vocal instruction and observing the position of the stimulus as it's rotated are a few ways in which these children rely on visual cues for emitting instructional responses. Simply put, because these children do not acquire the ability to discriminate speech sounds and follow simple directions, they have great difficulty in progressing educationally.

Chavez-Brown's (2005) research demonstrated that lack of phonemic control for listener responses has been associated with the inability to progress through more advanced stages within the verbal behavior developmental sequence. In another example, a study by Greer, Stolfi, et al. (2005) suggests that children must have a fluent listener repertoire in order to create the necessary conditions that can facilitate in linking the listener and the speaker within an individual. Thus, acquisition of listener literacy is essential in the development of listener behavior.

Greer and Ross (2008) state that listener behavior is important in the emergence of an echoic repertoire and is found to be crucial in the acquisition of early language capabilities and the development of more complex speaker repertoires such as Naming, self-talk, and say/do correspondence (Hart & Risley, 1995; Horne & Lowe, 1996; Lowe, Horne, Harris, & Randall, 2002; Greer, Chavez-Brown et al., 2005; Greer & Keohane, 2006; Greer & Ross, 2008; Greer & Speckman, 2009). Children with listener deficits who do not develop listener skills naturally have to be taught the listener repertoire.

The Listener Emersion Protocol for Establishing Listener Literacy

Greer, Chavez-Brown, et al. (2005), implemented a teaching procedure termed "listener emersion" to induce the development of true listener responses for students who did not have basic listener literacy (pre-listeners). According to these researchers, the intent of the "listener emersion" procedural tactic was to immerse the students in "intense instruction that required the student to respond only to the auditory properties of speech rather than other cues, such that they could only be successful by truly listening and thereby foster the emergence of the listener repertoire" (p. 3.)

Greer, Chavez-Brown et al. (2005) tested the effects of the "listener emersion" training procedure on rate of learning, prior to and following the intervention for eight preschool students diagnosed with autism. The participants chosen for this research did not have the prerequisite skills to respond fluently to the auditory properties of the speech of their teachers and required several sessions of instruction before meeting their instructional goals. A week before the onset of the study, each participant's learn units-to-criterion (weekly number of instructional trials required for a student to master an objective) across all academic programs were calculated and all academic programs were suspended during the implementation of the listener emersion procedure.

During the treatment phase, each participant was taught four sets consisting of four listener commands and one nonsense command. Each of these sets of listener commands was taught first to mastery and then to a rate criterion. After mastery of the rate-training phase, one of the sets was presented by different voices via an audio device (tape recorder). Following the completion of the listener emersion procedural tactic, previously suspended programs were reinstated and learn units-to-criterion for two

successive weeks were calculated for all participants.

Results from Greer, Chavez-Brown, et al.'s (2005) research showed that acquisition of a fluent listener repertoire was functionally related to the listener emersion protocol. Mastery of the listener emersion sequence resulted in an accelerated rate of learning across curricular instructional objectives from four to ten times faster than prior to the intervention. Thus, the protocol, by inducing listener literacy, helped to move the participants from a pre-listener level of verbal development to that of a listener. Furthermore, the experimenters (Greer, Chavez-Brown, et al. 2005) believed that once the participants acquired listener literacy it would lead to other complex verbal repertoires such as the development of an advanced listener repertoire as in the listener half of Naming and even Naming.

Procedures to Induce Naming

Building on Horne and Lowe's (1996) theory of Naming, VBD theorists were the first to empirically study the environmental experiences as well as the reinforcement history that provided the developmental sequence to show how the listener and the speaker, initially independent repertoires (Skinner, 1957), come to be joined, leading to complex verbal repertoires such as the Naming capability (Greer & Longano, 2010; Greer & Speckman, 2009).

The use of Multiple Exemplar Instruction (MEI) to induce Naming (Greer, Stolfi, et al., 2005) in children who do not have Naming has been well researched and has been the most widely replicated protocol to induce Naming (Cahill 2013; Fiorile, 2007; Greer, Stolfi & Pistoljevic, 2007; Greer & Longano, 2010; Gilic, 2005; Helou-Care, 2008;

Pistoljevic, 2008; Tullo 2013). However, other research studies have successfully shown that Naming can emerge from procedures other than the MEI intervention.

Stimulus-Stimulus Pairing to Induce Naming

Using a delayed multiple probe design across participants, Longano and Greer (in press) conducted three experiments to test for the source of reinforcement for Naming. In the first experiment, an echoic component was added to the MEI across the listener and speaker responses. The data showed that for three out of the four participants, Naming was acquired. In the second experiment, the participant from Experiment I who did not acquire Naming from the echoics acquired Naming after stimulus-stimulus pairing conditioned the echoic as a reinforcer. In Longano's third experiment, three participants who did not have Naming received the stimulus-stimulus pairing procedure used in the second experiment. That is, these participants went through a second-order classical conditioning procedure that paired visual stimuli with vocal responses. The data showed that for all three participants, Naming was acquired after several sessions of the pairing of visual and vocal speech stimuli. The results of Longano's study suggested that a history of stimulus-stimulus pairings functioned as a source of reinforcement for the joining of the listener and speaker behavior leading to the acquisition of Naming. In the final experiment, the echoic was not required; however, the experimenter found that echoic responding was observed in the listener probes for two of the three participants following the stimulus-stimulus pairings. This suggests that the echoic had acquired its reinforcement properties from the stimulus-stimulus pairing intervention.

Intensive Tact Instruction to Induce Naming

Pistoljevic (2008) tested the effects of the Intensive Tact protocol on the acquisition of Naming. She used a time-lagged design across participants and the results showed that by increasing the numbers of tacts the participants received daily, using the Intensive Tact protocol, Naming emerged for all participants. According to Greer and Longano (2010), the emergence of Naming from intensive tact instruction appears to be a function of the implicit rotation of speaker and listener opportunities found in the intensive tact protocol. Greer and Longano (2010) further suggest that the intensive tact protocol appears, for some children, to join the listener and the speaker repertoires. This experience in the joining of the two may be similar to what occurs with typically developing children as they learn the names for objects in their environment (Greer & Longano, 2010).

Listener Literacy and Listener Half of Naming

Greer, Chavez-Brown, et al. (2005) and Greer and Ross (2008) point out that the role of the listener is a key repertoire that is necessary for the development of the listener half of Naming. Greer and Ross (2008) define the listener half of Naming as an advanced listener repertoire that allows a child to respond as a listener after hearing a word spoken by a speaker. For instance, if a child has the listener component of Naming, the child, while learning to visually match an item (matching colors: red with red) can independently point to the stimulus (red) when asked to do so, without direct instruction. A child with this capability may, as a result of certain environmental experiences, even acquire the speaker component of Naming.

Feliciano (2006) implemented two experiments to test the effects of multiple exemplar instruction (MEI) on teaching the listener component of Naming for six children diagnosed with severe speech delays, including autism.

In Experiment I, three participants, after mastery of matching two-dimensional stimuli, were, while hearing the tacts for the stimuli, probed for the emergence of the listener component of Naming (point to or selection response) as a listener skill. Data from the probe showed that none of the participants acquired the listener component of Naming as a function of matching and hearing the tact. Following the probe session, MEI training sessions were implemented where the participants were taught to match and point to each of the target stimuli used in the training sets. During this phase, the participants were asked to match a target picture to its corresponding picture while the experimenter emitted the tact/name of each picture. The pictures were presented in a field of four pictures, where three of the four pictures were distracters (negative exemplars). Following two opportunities to match two different pictures in each set, the participants were then asked to point to one of the two target pictures. Once mastery was met for matching/pointing for the training sets using MEI, the participants were then probed for the point-to/selection response for each of these sets. Results showed that listener half of Naming emerged for the sets taught in MEI for all three participants.

In Experiment II, the experimenter used the exact MEI training procedure used in Experiment I, except in the second experiment, a novel set of stimuli was introduced to test for the emergence of listener responding as a point-to or selection response for the untaught stimuli (which functioned as a test for listener half of Naming). In addition, all three participants in the second experiment were probed for the emergence of both the

listener and the speaker components of Naming for the training sets and the stimuli used in the novel set. Results showed that after the participants had mastered the training sets under MEI, all three participants acquired the listener half of Naming and two of the three participants emitted the untaught speaker component of Naming.

Speckman-Collins et al. (2007) implemented a study to examine the effects of the auditory matching protocol on the emergence of the listener component of Naming. The participants were two preschool students with language-based developmental delays. In the Speckman-Collins et al.'s (2007) study, prior to the intervention, both students received instruction on matching pictures for Set 1 stimuli while hearing the experimenter tact the stimuli to a pre-set criterion of 90% for two consecutive sessions. Pre-intervention probe results showed that neither of the students had the selection or point-to response (as listener component of Naming) following mastery of match-to-sample pictures while hearing the tact as they matched. The dependent variables were the listener component of Naming, the number of full echoics, and emergent tact responses (speaker component of Naming). The independent variable was the same as the auditory matching protocol used in the Chavez-Brown (2005) study. That is, using Big Mac® buttons, the experimenters taught the participants to discriminate and match identical sounds, and then words that were identical. Following mastery of each phase of the auditory matching protocol, post probes with the same sets of stimuli were conducted for the listener component of Naming. The results from this experiment showed that the auditory matching protocol resulted in the emergence of the listener component of Naming for both participants.

Summary and Purpose of the Study

In reviewing the theoretical and conceptual research on the acquisition of a fluent listener repertoire, it has become apparent that children, when missing this skill, are missing a crucial developmental cusp without which progression to more complex levels of learning becomes impossible. Research has shown that children without a true listener repertoire cannot learn various listener responses incidentally, but have to be taught these responses directly and often several tactics have to be used by teachers to facilitate in the acquisition of these responses (Greer & Ross 2008).

Greer, Chavez-Brown, et al. (2005) basic listener literacy study showed that when the participants acquired a fluent listener repertoire, this functioned to accelerate the rate of learning of instructional curricular objectives for all participants. These results led the researchers to further propose that for children with autism or developmental delays having a *fluent listener* repertoire was a key prerequisite repertoire needed in the development of more advanced capabilities, such as the listener half of Naming and even Naming. However, in their research, there were no data to support this claim, thus demonstrating a need to test and further expand on the results of the Greer, Chavez-Brown, et al. (2005) study.

Based on the importance of establishing a listener repertoire and its link to the development of language, it became necessary to further examine the behavioral process that may allow the acquisition of one cusp, such as the listener repertoire, to lead to the acquisition of a more advance repertoire such as Naming. Therefore, the aim of the current study was to bridge the gap between the induction of the listener cusp and the emergence of more complex cusps such as the listener and the speaker halves of Naming.

Hence, in Experiment I, the experimenter sought to investigate: Does the listener emersion intervention result in a more rapid rate of learning for children who are functioning at a pre/speaker pre/listener level of verbal behavior? Does the listener emersion intervention lead to the development of a more advanced listener repertoire, such as the listener half of Naming?

Chapter II

General Method for Experiment I and II

Overview

The present experiments sought to extend the findings of previous research (Greer, Chavez-Brown, et al. 2005). This was done by introducing the listener emersion protocol and testing to see how it may be functionally linked to a fluent listener repertoire. This can be determined by rate of learning across curricula requiring listener responses as well as the listener and speaker components of Naming.

Experiment I focused on the effects of the listener emersion intervention on learn units-to-criterion (rate of learning) across listener programs and the emergence of the listener half of Naming in the form of a selection response (point–to) for Set 1 stimuli.

Experiment II included the same dependent variables as the first. However, I also tested whether or not Naming would emerge. In addition, I tested for Naming responses for a novel set of stimuli. In Experiment I, since my participants were pre-speakers, I did not measure the speaker component of Naming, nor did I probe for the listener half of Naming for a novel set of stimuli. In Experiment II, since my participants had more advanced levels of verbal behavior, I tested for both the listener and the speaker halves of Naming.

Experiment I

Participants

Three preschool-age students, who were diagnosed as preschoolers with a disability, participated in this study. The participants were selected from a self-contained, special education classroom. This classroom was part of a publicly-funded private preschool for children with and without developmental delays. The school was located in a suburban location of a major metropolitan area and it utilized the Comprehensive Application of Behavior Analysis to Schooling (CABAS®) model of education (Greer, 2002). All responses to instruction in the school were measured and presented as student responses to learn units (Albers & Greer, 1991; Greer, 2002). For all students in the school, long and short-term instructional objectives were chosen based on an assessment completed using *The CABAS International Curriculum and Inventory of Repertoires for Children from Pre-School through Kindergarten* (C-PIRK) (Greer & McCorkle, 2009; Waddington & Reed, 2009).

Participant A was a five-year old female who at the onset of the study functioned at a prelistener and prespeaker level of verbal behavior (Greer & Ross 2008). As a part of her instructional programs, she was able to maintain eye contact with the instructor when presented with the vocal antecedent (direction) "look at me." She was able to imitate simple one-step gross motor actions, follow a few listener directions (e.g. "sit down," "pick up," "stand up," "clap hands"), match non-identical objects, colors and pictures and point to some shapes and pictures. She emitted a few mands using single utterances (e.g. "cookie," "water," "candy").

Participant B was a four-year old male who functioned at a prelistener and

prespeaker level of verbal behavior. Prior to the onset of the study, he was able to emit eye contact when presented with the antecedent "look at me." He could also imitate simple one-step gross motor actions and follow limited one-step directions such as ("come here," "touch your head," "tap the table"). He emitted no vocal verbal operants and used an augmentative device (Dynovox®) to mand for his preferred items.

Participant C was a four-year old male who at the time of the study was functioning at an emerging listener and prespeaker level of verbal behavior. He emitted eye contact when presented with the vocal direction "look at me," followed simple one-step gross motor actions (e.g. the participant could clap hands, stomp feet, tap lap, raise arms). He could sit with his hands on his lap when presented with the vocal direction "sit still." Participant C emitted two word utterances ("oreo please," "juice please") to mand for his preferred items.

The three participants selected for this study were specifically chosen because pre-experimental tests showed that these participants did not have the listener half of Naming and because their learn units to criterion across their listener programs were high (i.e. it took an extensive number of instructional trials for these participants to meet their academic objectives).

Table 2 shows an overview of the participants' characteristics, age, grade, gender, diagnosis, and the cusps and capabilities that were present for each participant at the onset of the study.

Table 2

Participants' Descriptions and Verbal Developmental Cusps and Capabilities at the Onset of Experiment I

Description			
	A	B	C
Age	5	4	4
Gender	Female	Male	Male
Diagnosis	Preschooler with a disability	Preschooler with a disability	Preschooler with a disability
Level of Verbal Behavior	Pre-listener/Pre-Speaker	Pre-listener Pre-Speaker	Emergent-listener/speaker
Verbal Developmental Cusps/Capabilities			
	A	B	C
Teacher Presence Results in Instructional Control	Yes	Yes	Yes
Match 2D and 3D Objects (generalized matching)	Yes	Yes	Yes
Listener Literacy (i.e., hear-do; consonant-vowel sounds of others controls responding)	No	No	No
Echoic-to-Mand (i.e., mand function of repeating word sounds)	Yes	No	Yes
Listener Half of Naming	No	No	No
Repertoires	Emitted one word Mands Emitted a point topography Followed limited vocal directions	Used a device to communicate one word mands Emitted a point topography Emitted eye contact Followed limited vocal directions	Emitted one word mands Emitted a point topography Emitted eye contact Followed limited vocal directions

Setting

Pre- and post-intervention settings. All experimental sessions were conducted in the participants' classroom. Participants A, B, and C were in a classroom where the ratio of the classroom was six students to one teacher and six teaching assistants. The age of the other children in the classroom ranged from four- to five- years old. The classroom had five child-sized tables, one medium-sized circular table at the center of the classroom, and several child-sized chairs. The classroom also had a play area. The play area was located in a corner of the classroom and was approximately 3m by 2m. It contained two shelves on the wall that held toys, puzzles, and a container of playdough. The play area also contained a bookshelf that held various preschool books and a 6m by 9m animal-print carpet.

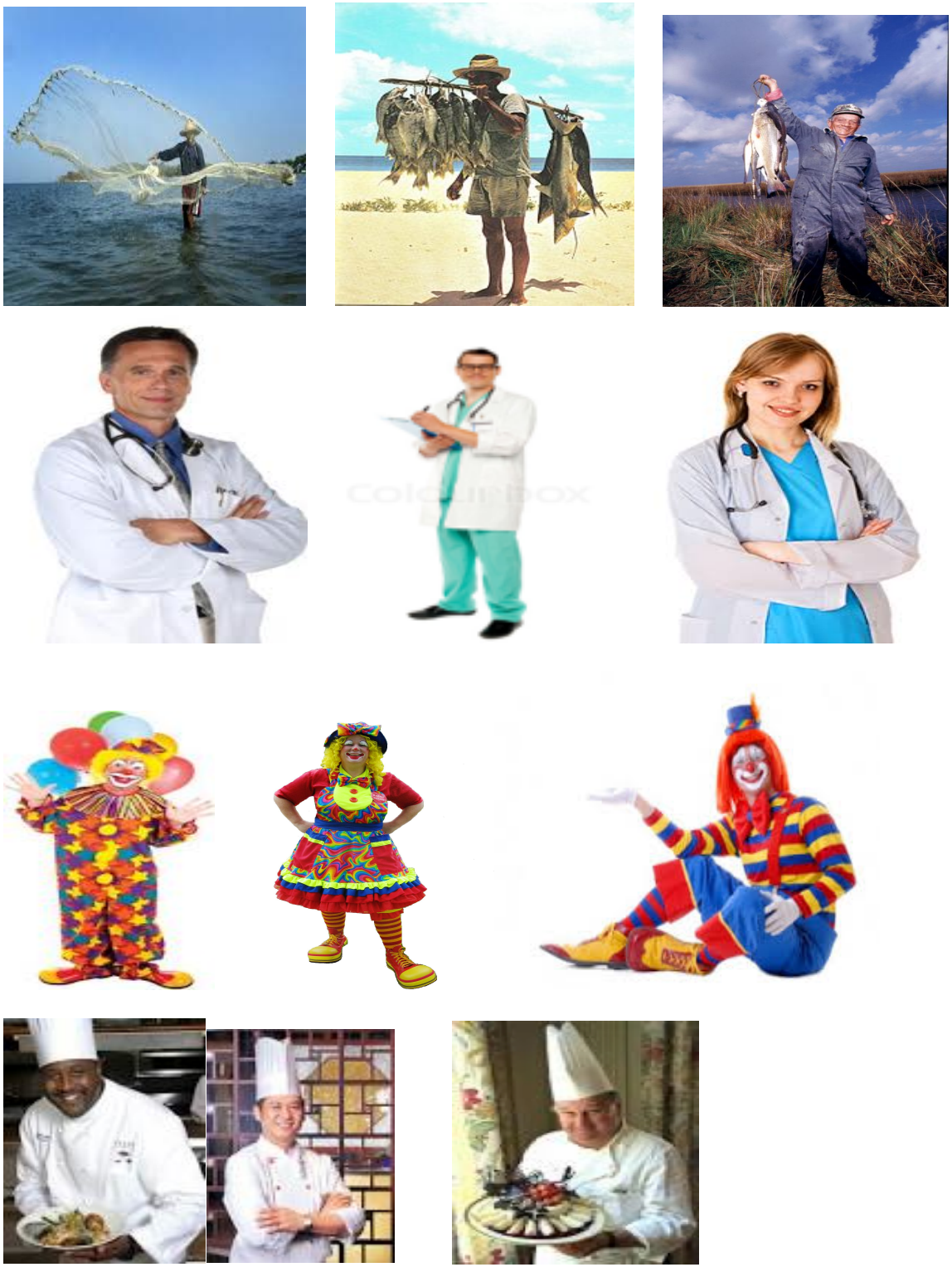
All experimental sessions (the pre-intervention probes, MTS sessions, intervention, and post-intervention probe sessions) were conducted with the participants sitting at one of the child-sized tables in a child-sized chair, with the experimenter sitting across from the participant in a child-sized chair. During the experimental procedure with the target participants, other students in the classroom who were not a part of the experiment were concurrently either receiving 1:1 instruction at adjacent tables or were playing alone or playing next to their peers in the play area.

Materials

The visual 2D materials used for the listener half of Naming (Set 1 stimuli) and the ones used in the listener emersion intervention for this study were all printed from a CD-rom called "*Picture This CD*" (augmentative resources, 2006). Each picture was

3cm by 3cm, printed in color, on a white background, and laminated. Three different visual exemplars for each of the 2D stimuli were used (Figure 1). An audiotape was also used to present recorded commands for one of the sets, which was consistent with the procedures used in the listener emersion protocol by Greer, Chavez-Brown, et al. (2005). Additional materials used for collecting data were black ink pens, data sheets, and graph.

Figure 1. The three different visual examples of each of the 2D pictures used in Set1 for the listener half of the Naming probe pre and post-listener emersion intervention.



Procedures

Data Collection

Data were collected as probe responses for: a) a pre-intervention screening test of Set 1 stimuli; and b) the untaught listener half of Naming prior to and following the listener emersion intervention. All probe trials conducted were presented without any consequences in the form of reinforcement or corrections from the instructor.

Data were collected as responses to learn unit presentations for the following instructional sessions: a) rate of learning of curricular objectives (learn units-to-criterion) prior to and following the listener emersion intervention; b) match-to-sample instruction for Set 1 stimuli; and c) listener emersion intervention sessions.

Experimental Design

A delayed non-concurrent, multiple-probe design across participants (Greer, Chavez-Brown, et al. 2005; Greer, Stolfi, et al. 2005) was used in the study to test the effects of the listener emersion intervention on the participants' rate of learning (number of learn units required to meet instructional objectives) and the emergence of the listener half of Naming.

The steps were as follow (a) first, participants' learn units-to-criterion across listener programs was calculated; (b) next, pre-intervention tests of (point-to) responses for Set 1 pictures was conducted; (c) then, match-to-sample instruction for Set 1 stimuli was implemented; (d) after, mastery of match-to-sample responses, a probe for the presence of listener half of Naming (untaught listener response) to Set 1 stimuli was conducted; (e) following, the probe the listener emersion intervention was implemented;

and (f) finally, once the participants completed all of the intervention phases, post-intervention probes to test for the induction of the listener half of Naming for Set 1 stimuli and calculation of learn units-to-criterion was carried out.

Design Sequence

The sequence of the intervention was time-lagged across participants to control for maturation and instructional history. In other words, following pre-experimental probes for Participant A, the independent variable (listener emersion protocol) was implemented. Once Participant A emitted a high number of correct responses for Set 1 of the intervention, pre-experimental probes were then conducted for Participant B. Following Participant B, who emitted a high level of correct responses to Set 1 of the listener emersion intervention, pre-experimental probes were then conducted for Participant C.

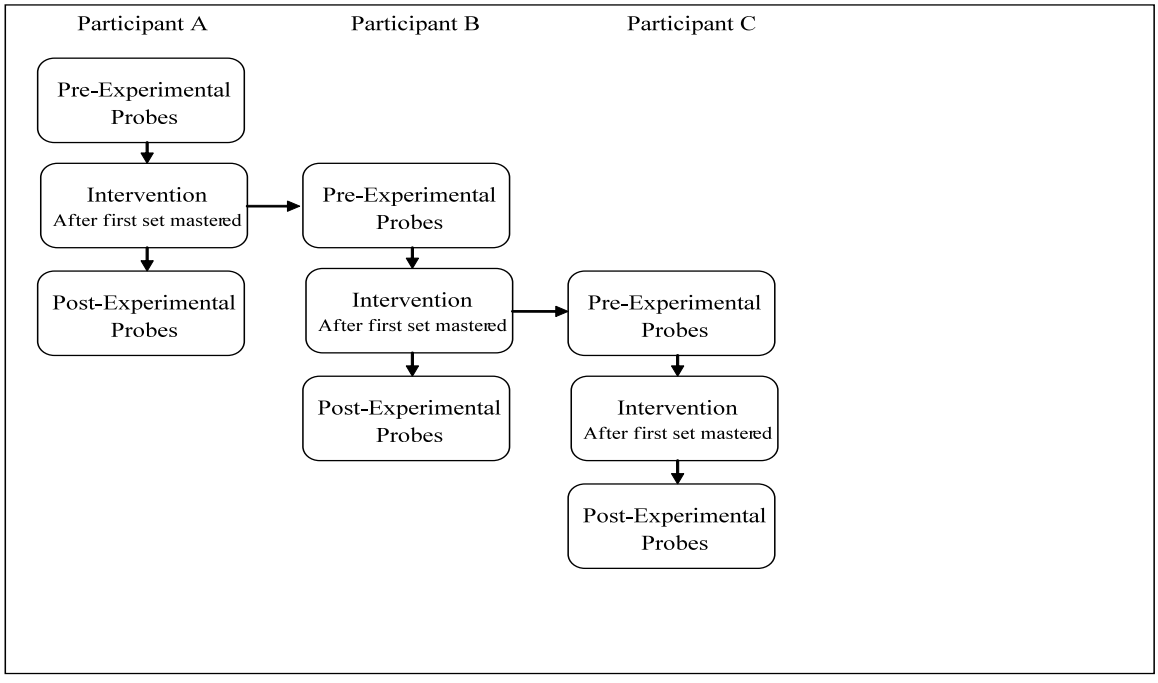


Figure 2. Sequence of Experiment I design.

Pre-Listener Half of Naming Screening Test of Set 1 Stimuli

Prior to the probe responses for the listener half of Naming and the intervention procedure, a pre-intervention probe was conducted for the four stimuli (Figure 1) in Set 1. This was done to ensure that the participants could not respond as a listener (point-to) to these stimuli. The probe session consisted of a total of 20 trials. A single probe trial consisted of each stimulus from Set 1 being presented. They were presented across three exemplars in a field of two pictures. One picture represented the positive exemplar (target picture, e.g. doctor) and the other stood for the negative exemplar (e.g. fisherman). Each exemplar was presented in front of the participant as the experimenter said the name of the target picture "point to ___." The participants had 3 s to respond, following the experimenter's vocal antecedent. If the participants pointed to the target picture data were recorded as a plus (+) on the data sheet and the experimenter moved on to presenting the next picture from Set 1. If the participants did not point to the correct picture, then the response was recorded as a minus (-) and the next picture was presented. During the pre-experimental probe phase, the participants were not given any feedback on correct or incorrect responses. Reinforcement in the form of praise and edibles were delivered sporadically throughout the probe session for known instructional behaviors, such as sitting with hands on lap, attending to the experimenter, emitting eye contact and gross motor actions.

Dependent Variables

Pre- and post-intervention: untaught listener half of Naming probes. In the pre-experimental probe phase, after the experimenter had established that the participants

were missing the listener response (point-to) for Set 1 stimuli, using match-to-sample instruction with the same set of stimuli, the experimenter then created the circumstances to set the occasion to test for the presence or absence of the listener half of Naming. The steps of the match-to-sample procedure was as follow 1) the experimenter presented in front of the participants on a child-sized table two pictures where one was the target exemplar and the other a non-exemplar, along with the corresponding picture of the (target stimulus); 2) following this, the experimenter provided the vocal antecedent "Match ___"; 3) The experimenter said the words for each stimulus and the participants learned to match the target stimulus correctly. The outcome for a correct match-to-sample response (matched the target stimulus) was the immediate delivery of reinforcement in the form of praise ("Fantastic!" or "Wow, good work!") and edibles (chips, gummies, chocolate). A plus (+) was also recorded on the data form. The outcome for an incorrect response (matching the target picture to the negative exemplar, or not matching at all) was a correction procedure that consisted of representation of the same vocal antecedent (e.g. "Match doctor") while concurrently taking the participant's hands and having him/her emit the correct response.

The participants were taught mastery of match-to-sample responses using learn units. Acquisition of the target skill was designated at 90% or better. That is, the participants had to emit 18 or greater correct responses out of 20 learn unit sessions across two consecutive sessions. It is important to note that the experimenter said the name of each stimulus during the match-to-sample sessions because visually matching the picture ensured *joint attention* to the visual stimuli and occasion to hear the words for the stimuli. In other words, this confirmed to the experimenter that the participants were

looking at the target stimulus *jointly* as the experimenter said the word for each stimulus. The aforementioned conditions allowed students with Naming to emit untaught listener and speaker responses (Pistoljevic, 2008).

The experimenter conducted probes for the untaught listener responses for Set 1 stimuli after the participants had met criterion on the match-to-sample responses. This was done while hearing the words for the same set of stimuli, following a 60 min time lapse. The probes consisted of each participant pointing to the target picture when it was presented on a table in an array of two pictures. One picture was the target exemplar and the other was a non-exemplar. The vocal antecedent "Point to____" was given. Speaker (tact, intraverbal) responses to the same set of stimuli were not assessed. The probes were conducted for a block of 20-trial sessions and the criterion for the presence of the listener half of the Naming repertoire was set at 80% or better for the untaught point-to repertoire. During the pre-experimental probes, responses were not consequated (i.e., no corrections or reinforcement were delivered). In order to maintain the participant's attention to the current task, delivery of reinforcement was identical to those presented during the pre-experimental probe sessions.

Once the participants had mastered all four sets in the listener emersion intervention to the final rate criterion for each set match-to-sample instruction was repeated with Set 1 pictures. Following the completion of the match-to-sample sessions, and a time lapse of 60 min, a post-intervention probe was then conducted for the listener half of Naming. This was done for Set 1 pictures using the same procedure that was used for Set 1 pictures during the pre-intervention probe.

Pre- and post-intervention: learn units-to-criterion (rate of learning). Participants rate of learning was measured by calculating each participant's learn units to criterion. Learn units-to-criterion was defined as the number of learn unit presentations required for each participant to achieve mastery of instructional objectives across listener curricular programs. Learn-units to criterion for each participant were calculated by adding the total numbers of objectives achieved for 1,000 learn units presented to the participants prior to and following the intervention. For example, once Participant A received a total of 1,000 learn units and if she had a total number of five objectives met across her listener instructional programs, learn units-to-criterion was then obtained by dividing the total number of learn units by the total number of objectives achieved (i.e. 1,000/5 = 200) (Greer, Chavez-Brown, et. al. 2005 & Greer 2002).

Independent Variable

Listener emersion intervention. The independent variable was the mastery of sets of listener commands using the learn unit and the listener emersion protocol developed by Greer, Chavez-Brown, et al. (2005). The intervention involved teaching listener commands that were divided into four different sets, each containing five training commands (See Table 5). One of the training commands required the participants to follow a one-step direction (e.g. "stand up" "clap hands"). Another training command required the participants to match a picture to its corresponding picture, while hearing the experimenter say the name of the picture (e.g. "match dog with dog"). A third training command required the participants to point to a picture of a stimulus (e.g. "point to cup"). It is essential to note that the stimuli for match and point-to were always present on the

table and so there was no "visual cue" that the next response would be a point-to or a match. A fourth training command required the participants to identify their body parts by pointing (e.g. "point to nose," "point to shoulder"). A fifth training command required the participants to simply do nothing when presented with nonsense direction (e.g. "blah, blah, blah," or "la, la, la"). The nonsense command was inserted into the training sets so as to ensure that the participants were actually attending to the auditory vocal stimulus. For example, if the participants were sitting with their hands on their laps, then a correct response would constitute the participants continuing to sit in that manner when delivered the nonsense direction.

Table 3

Description of the Sets Used in the Listener Emersion Training Procedure in Experiment 1.

Set 1	*Set 2*	*Set 3*	*Set 4 (via audio)*
Point to knees	Point to elbow	Point to shoulder	Point to arm
Raise arms	Clap hands	Stomp feet	Wave
Match dog (visual-visual MTS)	Match star (visual-visual MTS)	Match A (visual-visual MTS Uppercase letter on index cards)	Match ruler (visual-visual MTS)
Blah, blah, blah	Touch the sky	Sun is yellow	Go to India
Point to cup	Point to spoon	Point to block	Point to book

Within each set, these listener commands were presented in a random order to ensure that the participants could not predict the order of delivery of the commands. Therefore, instruction was counterbalanced in this way so that the participants could not predict the sequence of instruction based on an order effect. Under the mastery criterion the listener commands in Set 4 was audio taped using four different adult voices and presented from an audio device. The listener emersion training sets were first taught to mastery (participants independently emitting the listener commands at 90% accuracy for two consecutive 20 learn unit sessions) and then to a fluency criterion, which was established based on the individual participants. The listener emersion intervention was considered completed when the participants had met both the mastery and the fluency criterion. Following the completion of the intervention participants listener programs were reinstated.

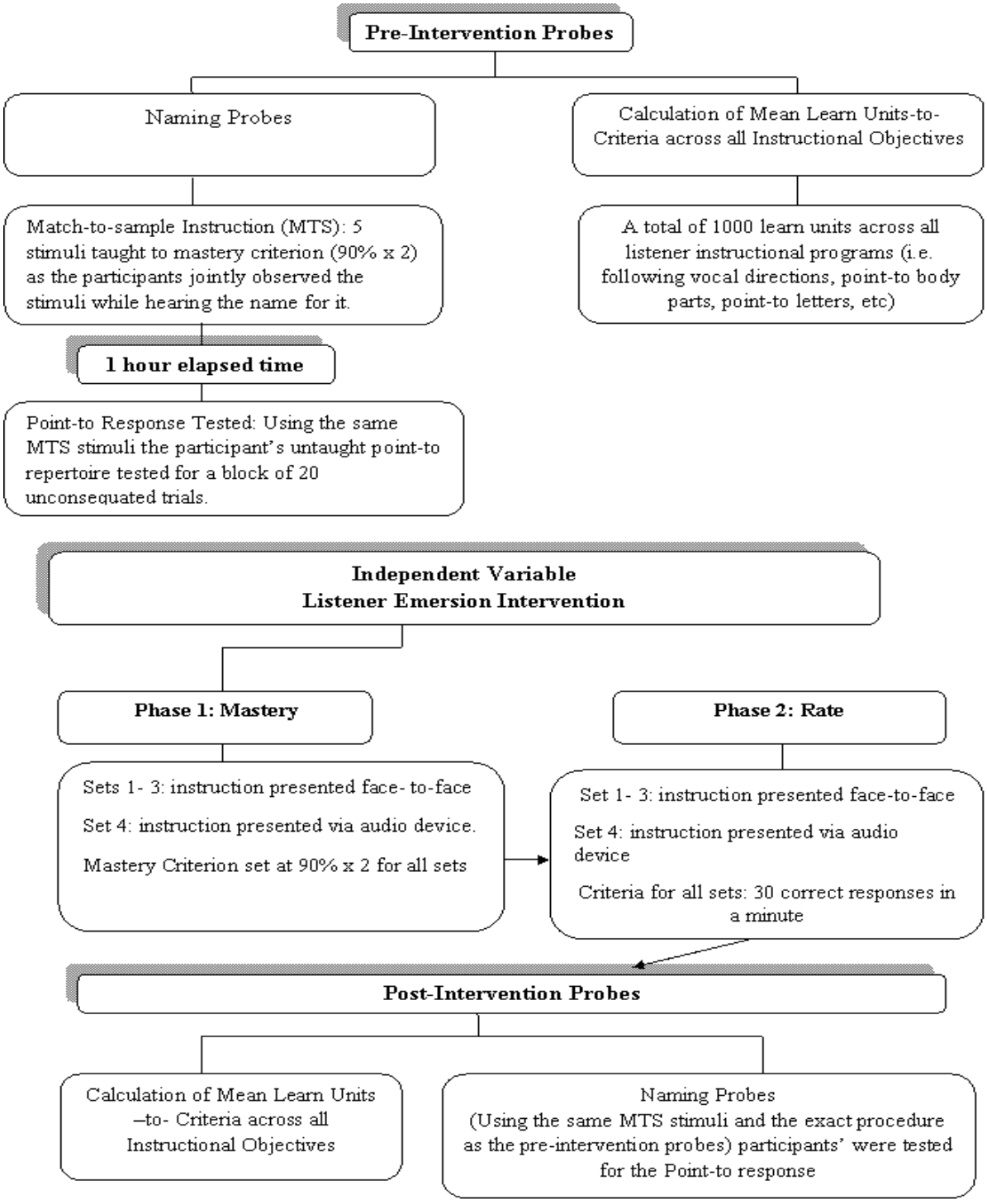
Mastery instruction with learn units. In order to teach the listener commands, in each listener emersion set, a zero-second time delay (Schuster, Gast, Woolery, & Guilttinan, 1988) with learn units was implemented. That is, once the participant was attending to the experimenter, she delivered a learn unit, which involved immediately prompting the participant to emit a target response. For example, following the delivery of the experimenter's vocal antecedent, "clap hands," the experimented physically guided the participant to clap hands. Following the participant emitting the prompted response, the experimenter, immediately reinforced the participant in the form of social praise ("Wow, nice job clapping your hands!") and edibles. A (P) was recorded on the data sheet for the prompted response and the experimenter moved on to present the next listener command. Following two 20 learn unit sessions of zero-second time delay a one-

second time delay was implemented. In the one-second time delay sessions after the experimenter delivered the vocal instruction (e.g. "clap hands,") the participant had only one-second to emit the target response (e.g. clap his hands). If the participant emitted a correct response, the experimenter, without any delay, reinforced the correct response in the form of social praise ("Wow, nice job clapping your hands!") and edibles. A plus (+) was recorded on the data sheet and the experimenter moved on to present the next listener command. If the participant did not respond at all in the one-second time delay period, the experimenter prompted or physically guided the participant to do so. Following the participant emitting the prompted response, the experimenter immediately reinforced the prompted response and recorded a (P) to imply a prompted response. If the participant emitted an incorrect response (e.g. stomping his/her belly instead of clapping his/her hands), the experimenter consequated the response by providing a correction by re-presenting the vocal direction "clap hands," while simultaneously taking the participant's hand and having him/her clap his/her hands. A minus (-) was recorded on the data sheet and the experimenter moved on to present the next learn unit. All four sets were taught to each participant simultaneously and once a participant met criterion on any one of the sets under the mastery phase, that set was then taught to the participant to a fluency criterion. In other words, the participant did not need to complete all four sets to mastery before moving to rate training. Each participant could be simultaneously working on emitting responses to one or more than one set to mastery and another set to fluency.

Fluency instruction with learn units. To teach the listener commands to rate, the experimenter set a timer for one minute, which was started immediately following the presentation of a vocal direction by the experimenter from a target set. The participant

had 2 s to respond. If the participant emitted the target response, a plus (+) was recorded on the data sheet and the experimenter moved on to present the next listener command. If the participant emitted an incorrect response or did not respond at all, the instructor recorded a minus (-) on the data sheet and moved on to present the next listener command. In order to not slow down the participant's rate of responding during the fluency or rate training phase, reinforcement in the form of edibles was delivered at the end of each training session. For example, following each correct response by the participant during the training sessions, the experimenter dropped a gummy or a goldfish into a clear plastic cup that was placed on the table next to the participant and was presented to him/her following the completion of the session. Consequences for incorrect responses were also delivered at the end of each session, by providing the participant with the representation of the vocal direction and then physically guiding him/her to emit the correct response. The participant was required to meet a predetermined terminal rate criterion, which was set at 30 correct responses within 1min That is, the participant was timed from the start of each set and was required to emit and complete an entire set within 1min. However, based on each participant's physical development and deficits in gross motor repertoire the terminal rate criterion was individualized for the participants. For example, Participant A, B, and C's poor gross and fine motor skills which impacted their ability to respond quickly latency of responding was taken into consideration when setting the terminal rate criterion. For Participant A and C terminal rate was set at 20 correct responses per minute for two consecutive sessions. Similarly for Participant B his terminal rate criterion was set at 17 correct responses per minute for two consecutive sessions.

Figure 3. A detailed sequence of the experimental steps that were involved in the pre- and post intervention of the listener half of Naming probes and the pre- and-post intervention learn units-to-criteria in Experiment I.



Interobserver Agreement

Interobserver agreement was collected by having a second observer simultaneously, but independently, recorded participants' responses to learn units during the intervention as well as during the probe trials. One of the second observers was a teacher who had graduated from the Applied Behavior Analysis program at Teachers College and was well trained in the CABAS® model of instruction. The other observer included classroom teacher's assistant who had received extensive training in applied behavior analysis and was trained in interobserver agreement procedure prior to the intervention. Additionally, Teacher Performance Rate Accuracy (Ingham & Greer, 1992) procedure was used as a measure to ensure fidelity of treatment and accuracy of each participant's responses during the intervention and during the unconsequated probe trials.

Interobserver agreement was collected for 100% of the probe sessions and mean percentage of agreement was 100% for the probe sessions. Interobserver agreement was calculated for 33% of the intervention sessions and the percentage of agreement was 95% with a range of 87% - 98%. Interobserver agreement was calculated for each session by dividing the total number of agreement trials by the total number of agreement plus disagreement trials and multiplying that number by 100% (Cooper, Heron, & Heward, 2007).

Results

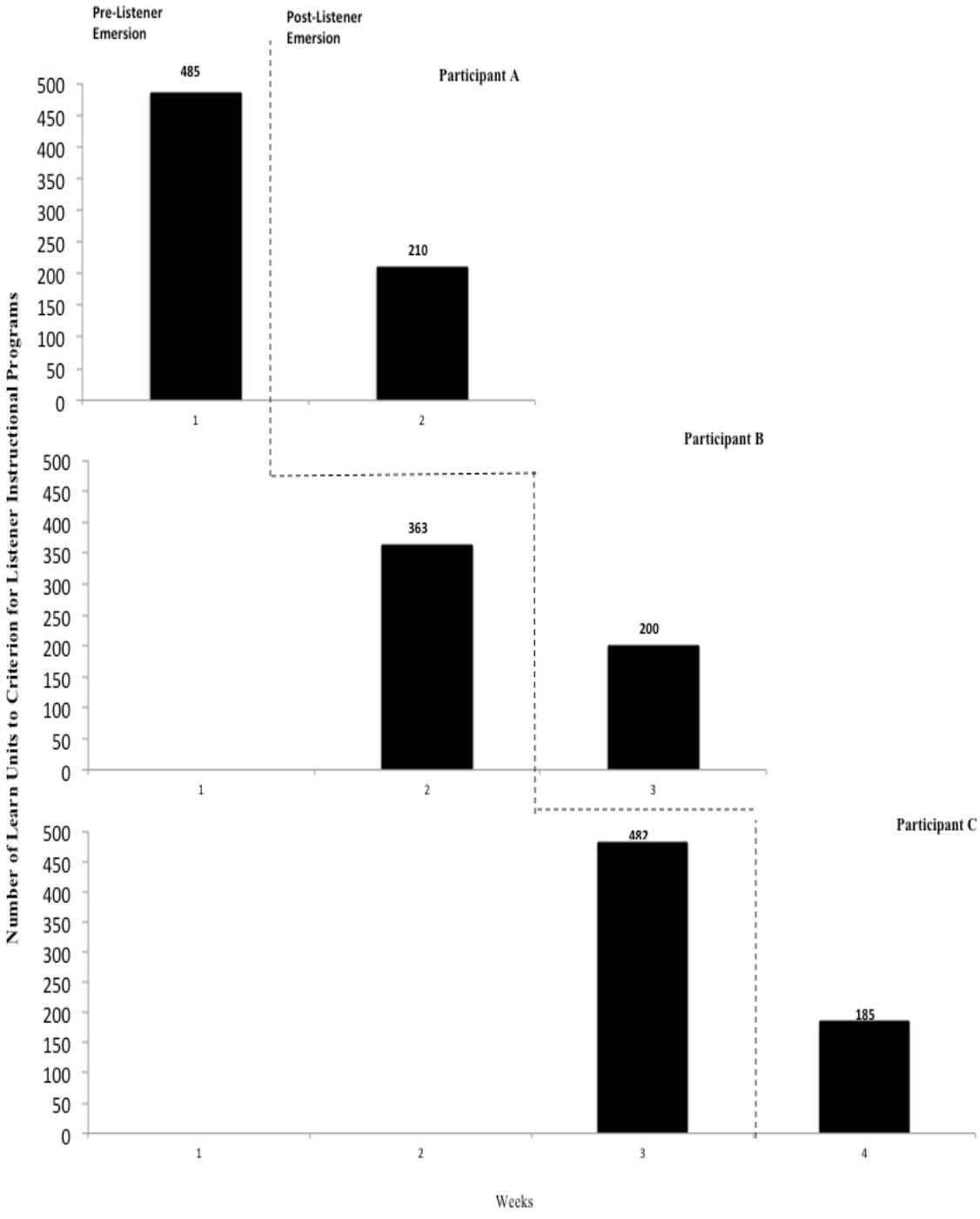
Pre-and Post-Listener Emersion: Learn Units to Criterion (Rate of Learning)

Figure 4 shows that the measure used to determine the rate of learning was learn-units-to-criterion. Prior to the listener emersion intervention, all three participants

required several sessions of instructional trials (learn units) across their academic programs and rate of acquisition of new objectives was slow. Following the listener emersion intervention, all three participants demonstrated fewer instructional trials to meet short-term objectives across their listener programs and the number of learn units required to achieve criterion decreased significantly.

Figure 4 shows Participants A, B and C's number of learn units-to-criterion prior to and following the listener emersion intervention. Prior to listener emersion intervention, Participant A's learn units-to-criterion was 485 across her listener instructional programs. Following the intervention, Participant A's learn units-to-criterion decreased to 210. Prior to the listener emersion intervention, Participant B's learn units-to-criterion was 363 across his listener instructional programs. Post intervention, his learn units-to-criterion decreased to 200. In Figure 4 the number of learn units-to-criterion for Participant C are also shown prior to and following the listener emersion intervention. The pre-intervention phase shows that for Participant C the number of learn units required to achieve criterion across his listener instructional programs was at 482. After the intervention, Participant C's learn units-to-criterion decreased to 185.

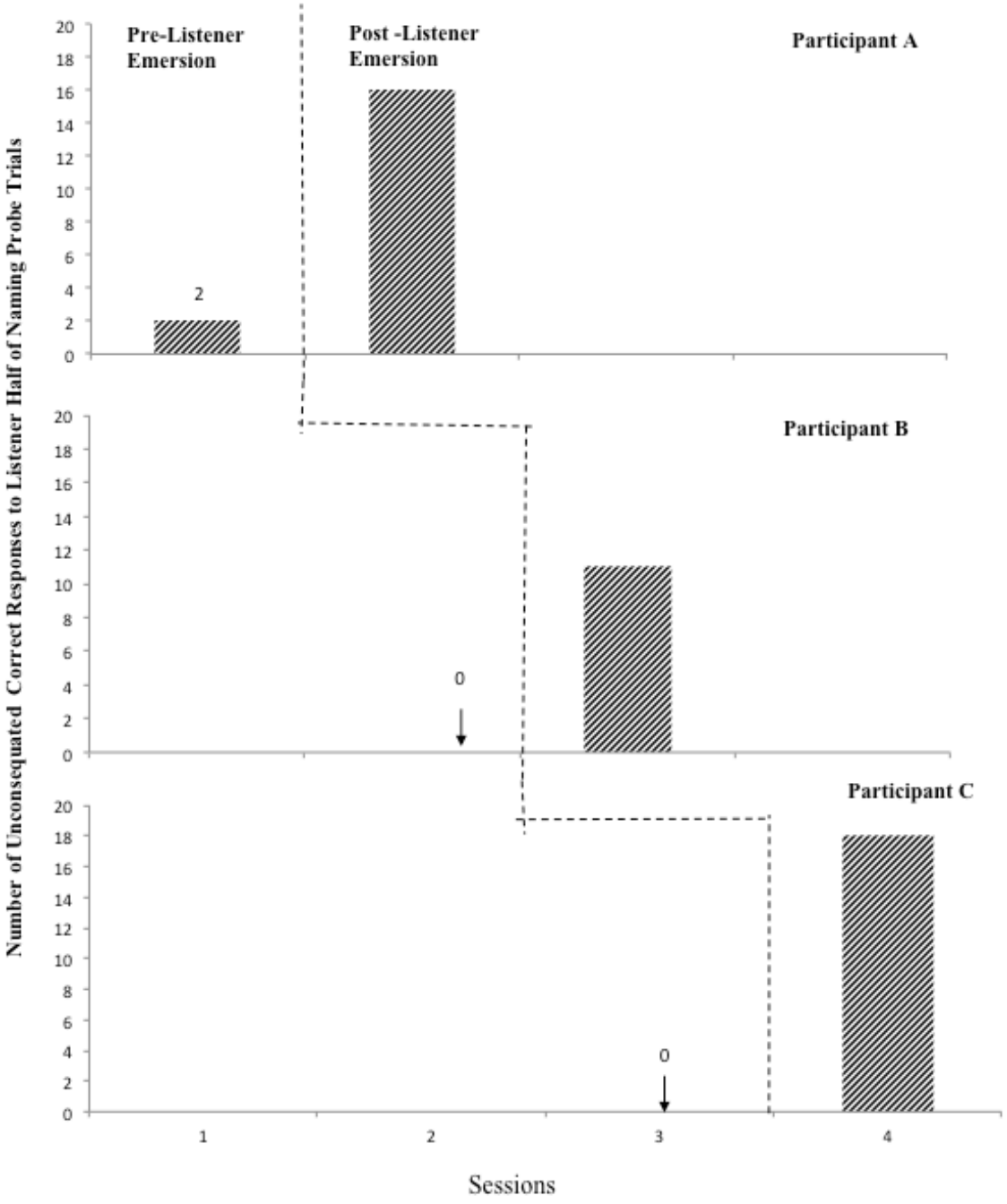
Figure 4. Shows Participant A, B, and C's mean number of learn units required to meet objectives for listener programs prior to and following listener emersion intervention.



Pre- and Post-Listener Emersion: Probe Trials for the Listener Half of Naming

The number of correct responses emitted by Participants A, B, and C for the emergence of the untaught selection, or point-to responses, as the listener component of Naming for both the pre-and post-listener emersion intervention conditions are shown in Figure 5. During the pre-intervention phase, the test for the listener half of Naming probe data showed that Participant A had emitted two instances of the untaught point-to (listener) responses following mastery of match-to-sample responses for Set 1 stimuli. Following the listener emersion intervention, Participant A emitted 16 correct responses out of 20 opportunities. Participant B, in the pre-intervention phase, emitted zero point-to responses following mastery of match-to-sample. Following the completion of the listener emersion intervention, Participant B emitted 11 correct responses out of 20 opportunities for the point-to, or selection response, for Set 1 pictures. Probe data for point-to response under the pre-intervention phase shows that Participant C, following mastery of match-to-sample responses while hearing the experimenter tact the pictures, emitted zero correct responses out of 20 opportunities. This was similar to the results of Participant B. Following listener emersion, Participant C emitted 18 correct responses out of 20 opportunities for the untaught point-to response for Set 1 stimuli. Participant C emitted the highest number of correct responses of the untaught point-to response as a listener component of Naming.

Figure 5. Shows number of correct untaught point-to responses as the listener component of Naming for Set 1 stimuli for Participants A, B and C prior to and following the listener emersion intervention.



Training sessions under the mastery criterion of the listener emersion intervention

Figure 6 show that all participants acquired the correct responses across the listener emersion training sets through the implementation of a zero-second time delay instructional procedure with learn units. Following 20 learn units of two sessions of zero-second time delay a 1-second time delay was implemented. In the 1-second time delay sessions, Participant A required a total of 38 sessions to complete all four listener emersion sets. She emitted a total of 519 correct responses out of 760 opportunities. Her correct responses ranged from 3 to19. Participant B required 47 sessions to complete all four listener emersion sets and he emitted a total of 593 correct responses out of 940 opportunities. His correct responses ranged from 5to 18. Participant C required a total of 40 sessions to complete all four sets. He emitted a total of 655 correct responses out of 800 opportunities and his correct responses ranged from 5 to 20.

Training sessions under the fluency criterion of the listener emersion intervention. In Figure 7, data for Participant A shows that under the fluency instruction of the listener emersion training sets she required 10 sessions for Set 1 and 9 sessions for Set 2 to meet the mastery fluency criterion. For Set 3 and 4 she required 6 and 5 sessions respectively to meet the fluency criterion. Data for Participant B shows that he required 8 sessions for Set 1, 7 sessions for Set 2, 9 sessions for Set 3, and 7 sessions for Set 4 to meet the listener emersion mastery rate criterion. Data for Participant C shows that for Set 1 he required a total of 9 sessions to meet the mastery rate criterion. For Set 2, 3, and 4 he met the mastery rate criterion after 6 sessions.

Figure 6. Shows the number of correct responses emitted under the mastery criterion of the listener emersion intervention for Participants A, B and C.

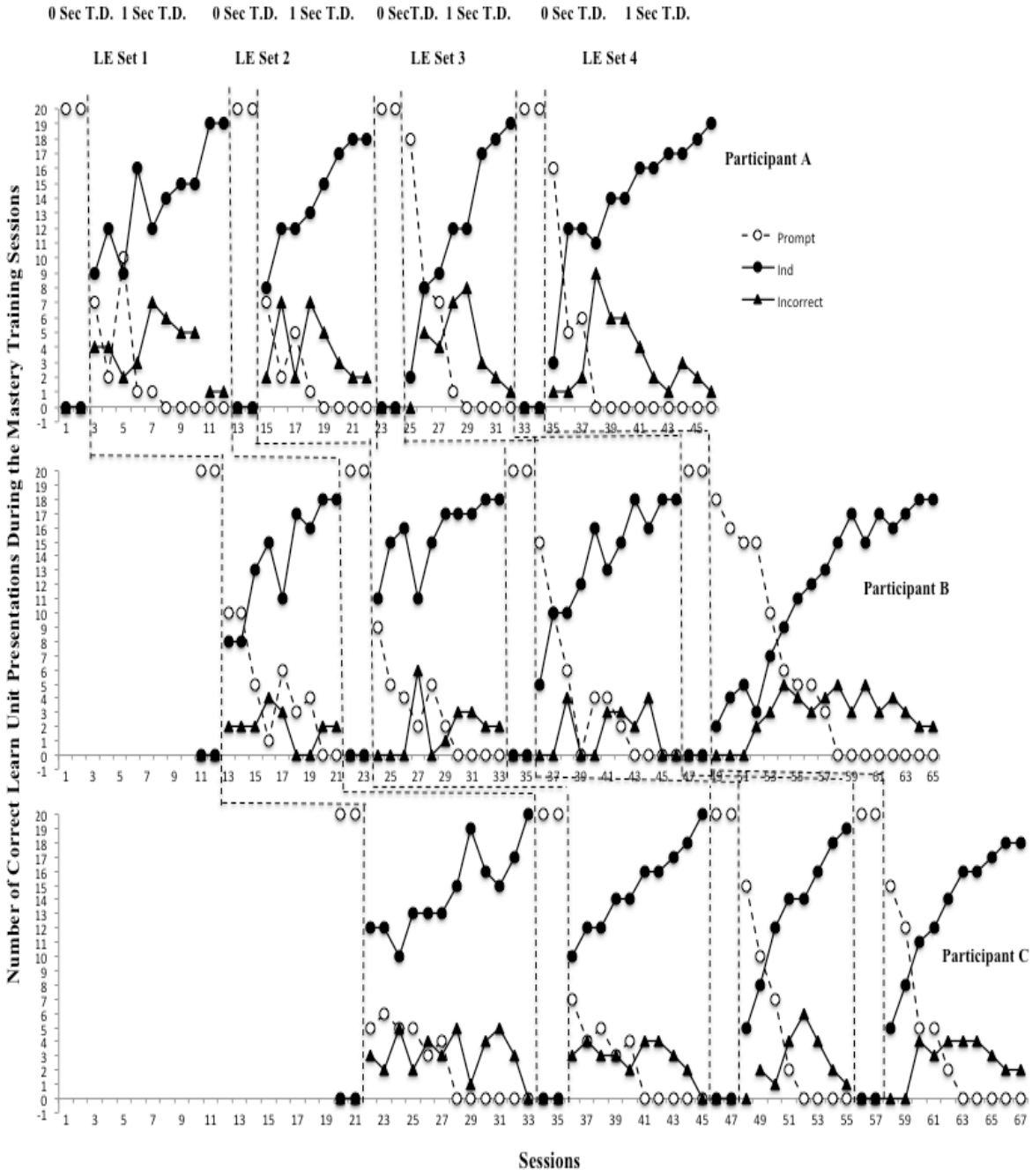
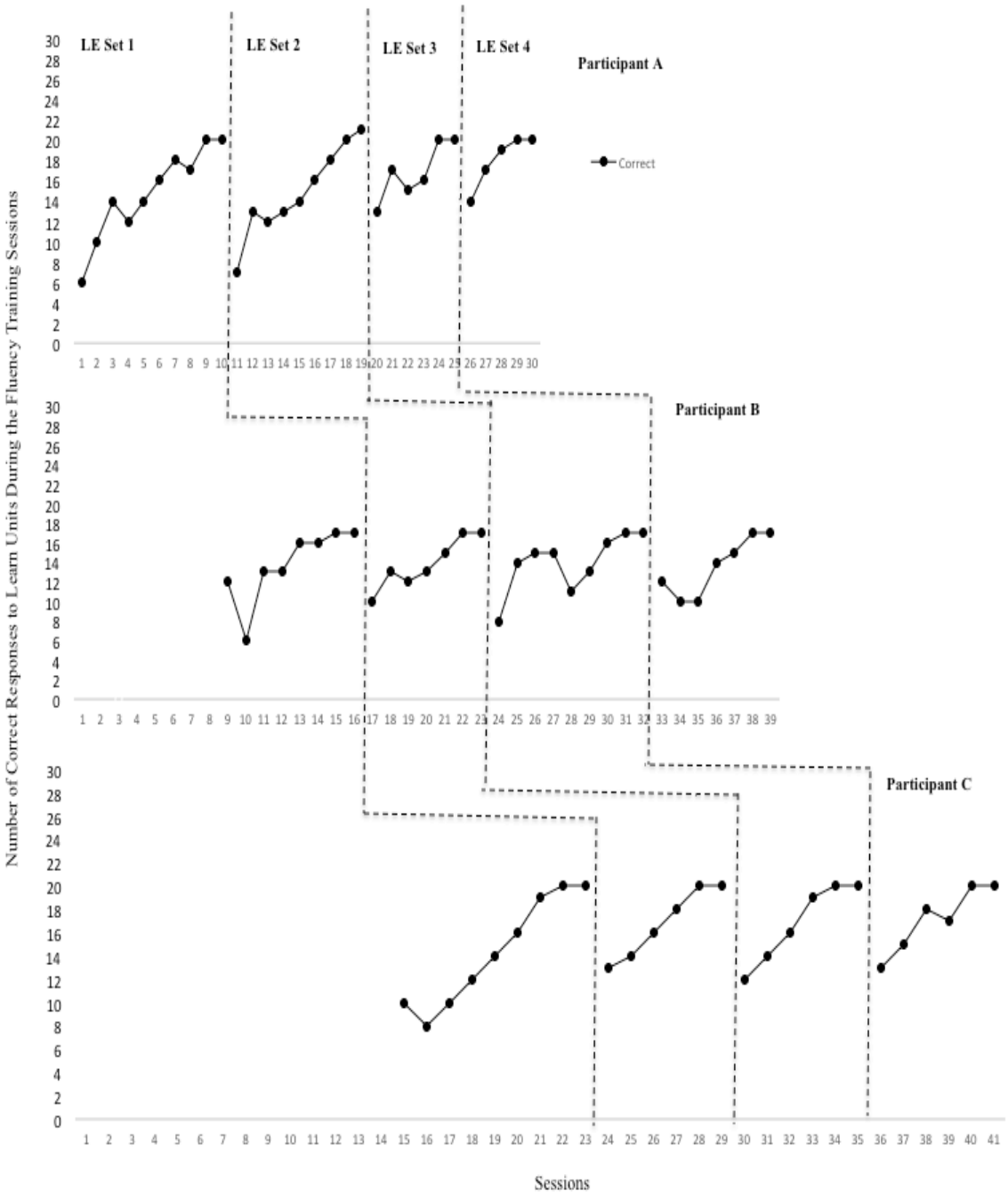


Figure 7. Shows the number of correct responses emitted under the fluency criterion of the listener emersion intervention for Participants A, B, and C



Discussion

The results from Experiment I demonstrated that the listener emersion intervention was effective in accelerating each participant's rate of learning across their listener programs and in the emergence of the listener half of Naming for Participants A and C. Even though Participant B did not acquire the listener half of Naming he did demonstrate a significant increase of the selection response (point-to responses) during post-probe for Set 1 pictures. Therefore, the data in Experiment I support the research questions that I sought to investigate: Does mastery of the listener emersion intervention result in rapid acquisition of listener literacy? Does the listener emersion intervention lead to the induction of a more advanced repertoire, such as the listener half of Naming?

Children with autism or speech delays typically do not have a fluent listener repertoire and because they do not discriminate between different speech sounds, they often become very good at responding to instructions through visual cues (Greer, Chavez-Brown, et al. 2005; Greer & Ross, 2009). Prior to the experiment, all three participants' number of learn units-to-criterion across their listener programs were very high, thus demonstrating that it was taking these participants several sessions of instruction to master their listener objectives. Following the intervention, all three participants demonstrated significant increases in their rate of learning across the same listener programs that were in place prior to the intervention. One possible justification for this is that the listener emersion intervention involved teaching the participants intense listener commands that required the participants to respond only to the acoustic properties of speech. In other words, the intervention, by isolating the auditory sounds of

the vocal directions, functioned to develop auditory stimulus control. This facilitated in the development of a true listener repertoire, thus improving all three participants' ability to listen and correctly respond to the experimenter's vocal instructions. Therefore, it can be surmised that the listener emersion intervention successfully established a developmental nexus between the auditory properties of speech and true listener responding. Similar results were also found by the Greer, Chavez-Brown, et al. (2005) study and thus lend support to this hypothesis. Results from the current study further suggest that once the participants acquired the listener repertoire they also acquired the ability to demonstrate a more complex repertoire, such as the listener half of Naming.

Researchers Greer, Chavez-Brown, et al. (2005) hypothesized that the acquisition of a fluent listener repertoire was a key repertoire needed to develop more advanced levels of verbal behavior, such as listener half of Naming and Naming. Research to test this hypothesis using the listener emersion intervention had not been done yet. Hence, the following question was raised: Can listener emersion instruction induce the listener half of Naming? Prior to the intervention, pre-intervention probes conducted to test for the presence or absence of the untaught listener responses for Set 1 stimuli showed that none of the participants could discriminate the stimuli in Set 1 as a listener; thereby demonstrating that these participants were missing the listener half of Naming repertoire. Greer and Ross (2008) posit that teaching true visual discrimination skills where children learn to match (e.g. objects, colors, shapes, pictures and shapes) requires learning about the correspondence between hearing and performing. The listener repertoire is seen as the foundation to this repertoire. Pre-intervention data in Experiment I showed that the participants who lacked a fluent listener repertoire also lacked the listener half of

Naming. All three participants failed to demonstrate a connection between the visual (match response) and the auditory (listener response). In other words, even after participants A, B, and C had mastered matching the target stimuli-to-criterion for Set 1 stimuli, they failed to emit the untaught listener response when asked to identify the target stimuli by pointing to it. This demonstrates that these participants may have been under only *visual* and not under auditory stimulus control. Once the participants mastered the listener emersion intervention and acquired stimulus control for the listener repertoire, they concurrently acquired a higher level of verbal repertoire, the listener half of Naming. For instance, Participant A and C following the listener emersion intervention demonstrated that they had acquired the listener half of Naming for Set 1 stimuli. Although Participant B did not acquire the listener half of Naming, he did demonstrate a higher number of correct responses for the point-to/selection response for listener half of Naming, post intervention.

Limitations of Experiment I

There were a few limitations in Experiment I. One of the major limitations of the present experiment was that following the intervention, and prior to the listener half of the Naming probe phase, match-to-sample instruction was reintroduced with Set 1 pictures. The participants were required to match after hearing the experimenter tact the stimuli. Since the participants had the opportunity to hear the tact for a target stimulus while matching, this may have influenced the number of correct untaught listener responses. Another limitation was the selection of participants. Participants A and C had very limited levels of speaker repertoires, while Participant B did not have any speaker

behavior and used a device to communicate. Furthermore, due to Participant A and B's poor motor deficits, latency of response had to be taken into consideration when these participants were performing under the rate phase of the intervention. Therefore, since a more uniform participant selection measure was not employed prior to the onset of Experiment I, testing for the emergence of the speaker component of Naming could not be conducted.

Another limitation of Experiment I was that an additional set (novel set) of 2D stimuli was not used following the completion of the intervention. An additional set should have been used to facilitate and thereby further strengthen the emergence of the listener half of the Naming repertoire for Participants A and C. Another limitation of the present experiment was that following the intervention, and prior to the listener half of the Naming probe phase, match-to-sample instruction was reintroduced with Set 1 pictures. The participants were required to match after hearing the experimenter tact the stimuli. Since the participants had the opportunity to hear the tact for a target stimulus while matching, this may have influenced the number of correct untaught listener responses that were emitted by participants A, B, and C.

Another possible limitation of Experiment I, was that during the post-listener emersion phase, each participant's learn units-to-criterion was only calculated once. It may have further strengthened the findings of the Greer, Chavez-Brown, et al. (2005) study to have maintained the effects of the listener emersion intervention on the participants, learn units-to-criterion for two successive sessions.

Consequently, to further the findings of Experiment I on the acquisition of listener literacy and accelerated rate of learning and its effects on the induction of the Naming

repertoire, Experiment II was implemented with participants who were functioning at similar levels of developmental cusps and repertoires.

Rationale for Experiment II

It is indisputable that the development of the listener repertoire is necessary for the advancement of the speaker repertoire. Since the participants in Experiment I had limited listener and speaker abilities, the primary aim of Experiment I was to test the applicability of the listener emersion intervention only on the induction of the untaught listener and not the speaker half of Naming for these participants. The major objective of Experiment II was to test the relationship between the establishment of the listener cusp and Naming. To test the efficacy of the listener emersion intervention on the development of a more advanced repertoire such as Naming (listener and speaker repertoires) four participants who lacked the Naming repertoire were chosen to participate. Therefore, a leading difference between the two Experiments was that the participants in Experiment II were functioning at a more advanced speaker and listener level of verbal behavior, versus the prespeaker participants in Experiment I. In addition, another distinction between Experiment I and II, was that in Experiment II a novel set of stimuli was also used to test for the emergence of both the listener and speaker components of Naming.

Thus, in Experiment II, the following research questions were examined: a) Will the listener emersion intervention lead to an accelerated rate of learning for these participants as well? and b) If the listener emersion intervention can lead to the induction of the listener half of Naming, can it also function to induce the speaker half of Naming?

Chapter III

EXPERIMENT II

Method

Participants

The participants for the second experiment were four preschoolers chosen from the pool of students belonging to the same school as the participants in Experiment I. For Experiment II, prior to the onset of the intervention, probe data showed that these four participants did not have the Naming repertoire. Additional criteria for selection were the same as in Experiment I. The only difference in the participants in Experiment II was that they were all functioning at a speaker level of verbal behavior versus the prespeaker participants in Experiment I (See Table 4 for a full description of the participants).

Table 4

Participants' Descriptions and Verbal Developmental Cusps and Capabilities at the Onset of Experiment II

Description	**Participants**			
	D	E	F	G
Age	4.5	4.5	5	3.6
Gender	Male	Male	Female	Male
Diagnosis	Preschooler with a disability	Preschooler with a disability	Preschooler with a disability	Preschooler with a disability
Level of Verbal Behavior	Emergent-Listener/Speaker	Emergent-Listener/Speaker	Emergent-listener/speaker	Emergent-listener/speaker
Verbal Developmental Cusps/Capabilities				
	D	E	F	G
Teacher Presence Results in Instructional Control	Yes	Yes	Yes	Yes
Conditioned Reinforcement for 3D Objects/Visual Stimuli on Desktop	Yes	Yes	Yes	Yes
Generalized matching 2D and 3D Objects	Yes	Yes	Yes	Yes
Generalized Imitation	Yes	Yes	No	Yes
Listener Literacy (i.e., hear-do; consonant-vowel sounds of others controls responding)	No	No	No	No
Echoic-to-Mand (i.e., mand function of repeating word sounds)	Yes	Yes	Yes	Yes
Echoic-to-Tact (i.e., generalized reinforcement for at least two tacts)	Yes	Yes	Yes	Yes
Listener Half of Naming	No	No	No	No
Speaker Half of Naming	No	No	No	No
Book Stimuli as Conditioned Reinforcement for Observing	Yes	No	Yes	Yes
Repertoires	Emitted 3 word mands (I want ___) Emitted tacts with autoclitics (e.g. a___) Followed limited vocal directions Emitted 2 step gross motor actions	Emitted 2 word mands (want ____) Emitted one word tacts Followed limited directions Demonstrated Action on self	Emitted 3 word mands (I want ___) Emitted one word tacts Followed limited vocal directions Textually respond to letters (A-Z)	Emitted 4 word mands (I want ____please) Emitted tacts with autoclitics (e.g. a__) Followed limited vocal directions

Setting and Materials

Pre- and post-intervention settings For Participants D, E, F and G, the setting for the intervention was identical to that of Experiment I. In Experiment II, during the pre-intervention screening test for Set 1 stimuli, the experimenter observed that all four participants independently emitted the names of some of the pictures (community helpers) used in Experiment I. Therefore, there was a difference in the pictures used for Set 1 stimuli versus those used in Experiment I. Also, an additional set of pictures Set 2 (i.e. novel set) was implemented in Experiment II.

Table 5

Description of Set 1 and 2 Stimuli used for the listener and speaker components of Naming for all participants in Experiment II

Set 1	Set 2
Lizard	Chimney
Razor	Cactus
Mushroom	Bamboo
Grasshopper	Palm Tree

Figure 8. The different visual examples of each of the 2D pictures used in Set1 for the listener half of the Naming probe pre- and post-listener emersion intervention.

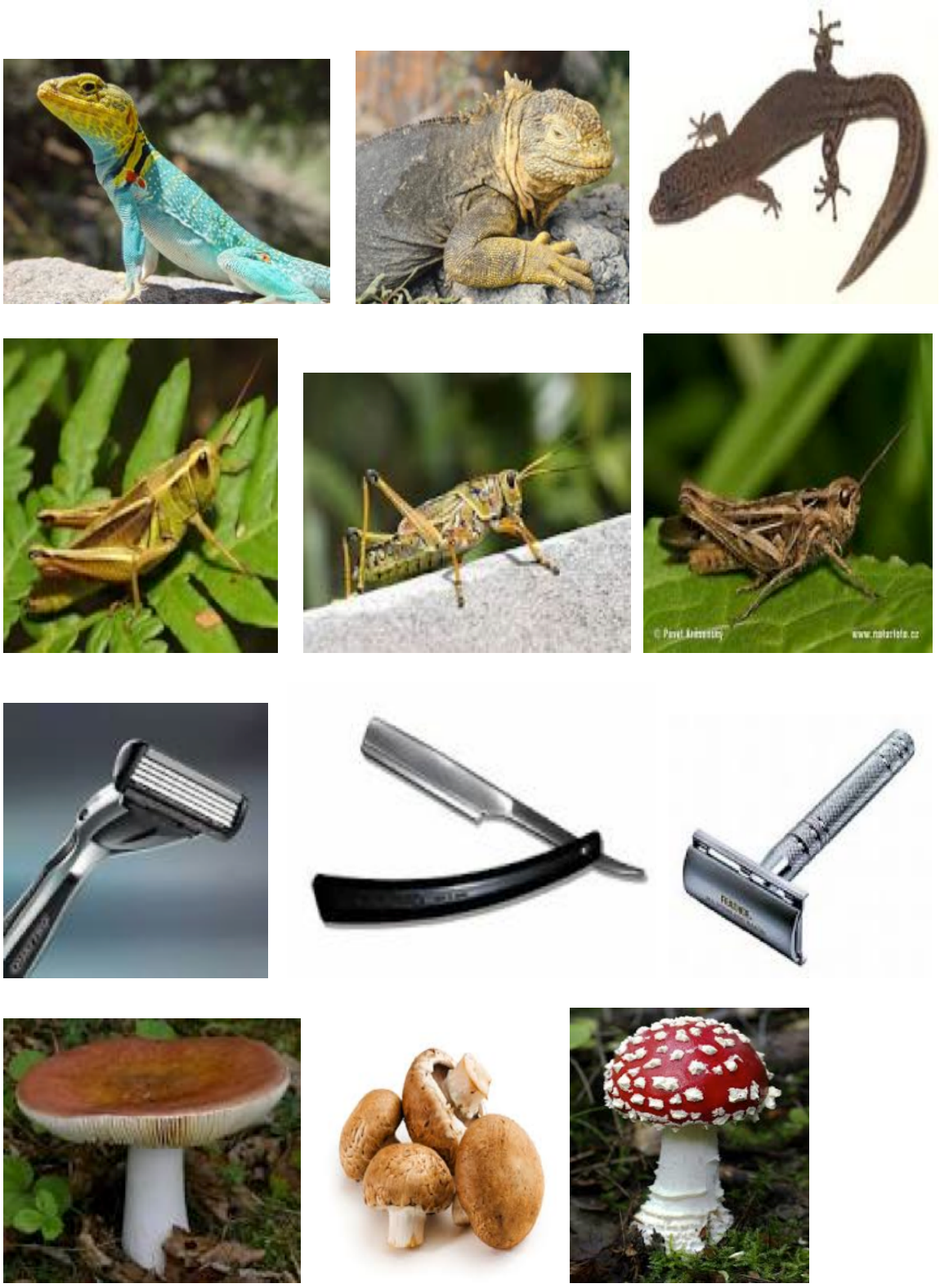


Figure 9. The different visual examples of each of the 2D pictures used for the novel Set2 for the listener and the speaker half of the Naming probe pre- and post-listener emersion intervention.

Procedures

Data Collection

Data were collected as probe responses for: a) pre-intervention screening tests of Set 1 stimuli; and b) untaught listener and speaker components of Naming prior to and following the listener emersion intervention. All probe trials conducted were presented without any consequences, neither in the form of reinforcement nor corrections from the instructor.

For all instructional sessions, data were collected as responses to learn unit presentations for: a) rate of learning of curricular objectives (learn units-to-criteria) prior to and following the listener emersion intervention; b) match-to-sample instruction for Set 1 stimuli; and c) listener emersion intervention sessions.

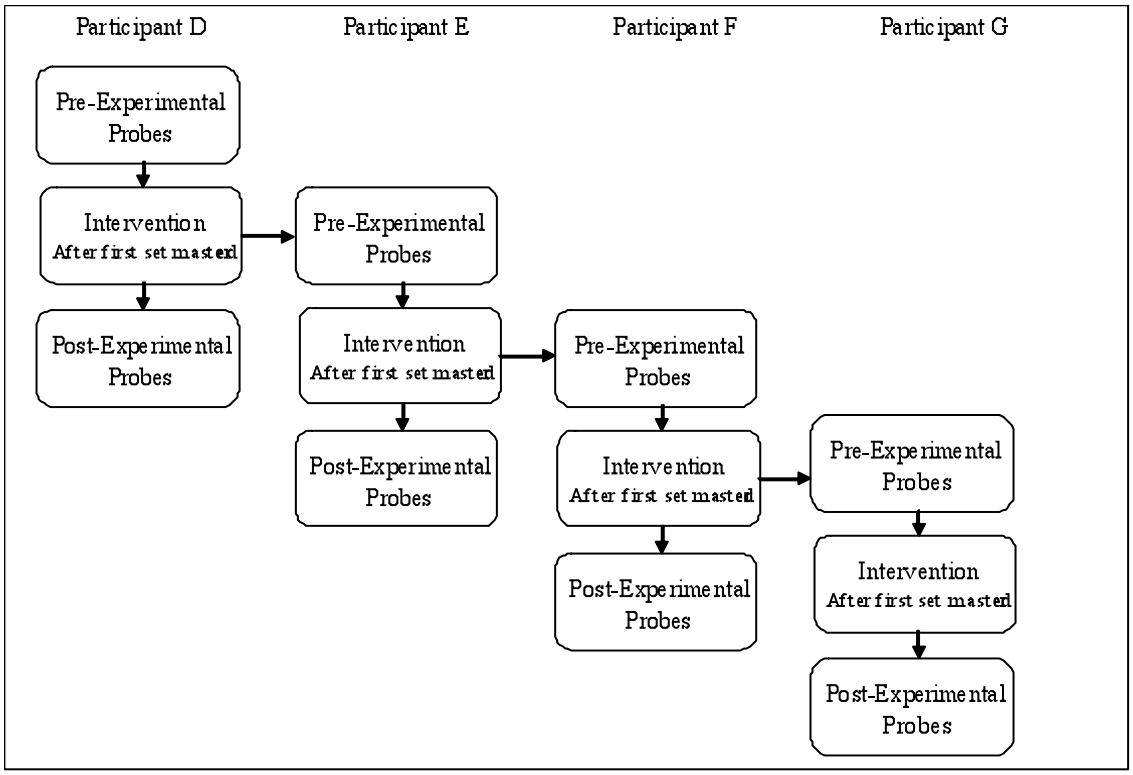
Experimental Design

A delayed, non-concurrent multiple probe design across participants was used in which the number of correct responses to the Naming probes was compared for probe sessions that were conducted prior to the implementation of the listener emersion intervention and following the mastery of each phase of the intervention. In addition, after the participants met criteria under the listener emersion intervention, a novel set of 2D stimuli was probed to test for the presence of the Naming repertoire. Also, participants' learn units-to-criterion were calculated to compare the effects of the listener emersion intervention on the participants' rate of learning prior to and following the completion of the listener emersion intervention. Instruction was time-lagged across participants to meet the criterion of the multiple probe design.

Design Sequence

The sequence of the design was as follows: following the pre-experimental probes, the listener emersion intervention was implemented for Participant D. Once Participant D emitted a high level of responding under the mastery phase for the first listener emersion training set, the intervention was then implemented for Participant E. Similarly, once Participant E emitted a high level of responding, the intervention was implemented for Participant F. After Participant F showed a high level of responding for the first listener emersion training set, the intervention was implemented for Participant G. Following mastery of the listener emersion training sessions under the fluency criterion, post probes for Naming Set 1 stimuli were conducted (staggered) across participants. Following the completion of the entire intervention, Naming probes for the Novel Set were conducted and learn units-to-criterion were calculated.

Figure 10. Experiment II design sequence.



Pre-Naming Screening of Set 1 Stimuli

Prior to the intervention, in order to rule out that the participants could not respond as a listener (point-to) or as a speaker (tacts and intraverbal) to the stimuli in Set 1, pre-Naming screening tests were conducted for the stimuli first. Using the exact procedure described in Experiment I pre-Naming screening of the listener half of Naming was conducted in Experiment II. To test for the speaker halves of Naming

Dependent Variables

Pre- and post-intervention Naming probe. Prior to the listener emersion intervention and after the experimenter had established that Set 1 stimuli were not familiar to the participants, test for the presence or absence of Naming was then conducted. The steps and the criterion for the match-to-sample training procedure employed in Experiment II were identical to the procedure used in Experiment I. After the participants had met the criterion on the match-to-sample responses while hearing the experimenter saying the words (tact) for the stimuli, the experimenter waited 60 min before testing for the emergence of the untaught listener and speaker Naming probes for Set 1 stimuli. Each of the topographies (point-to, tact and intraverbal) was presented for a block of 20 unconsequated probe trials.

The probe session for the listener response was carried out in the exact same manner as it was implemented in Experiment I, with minimum variation in the number of pictures presented in front of the participants. A single probe trial consisted of each stimulus from Set 1, which was presented across three exemplars in a field of three pictures versus two pictures, the same as it was presented in Experiment I. For example,

one picture was the positive exemplar (target picture, e.g. lizard) and the other two were the negative exemplars (e.g. grasshopper and mushroom). Probe sessions for the pure tact responses (speaker responses) required the participants to tact the pictures when presented with the target stimuli in front of them, without a vocal verbal antecedent presented by the experimenter. Also, probe sessions were conducted for the intraverbal speaker response for the given set. In order to test for the intraverbal response, the participants were required to respond vocally by saying the name of the pictures when the experimenter held up the pictures and presented the participants with the question "What is this?" Data for correct and incorrect probe responses were collected in the same manner as in Experiment I. Criterion for the presence of the untaught listener and the speaker responses of the Naming repertoire was set at 80% or better across both Set 1 and the novel set.

Once the participants had mastered the rate criterion for all four sets in the listener emersion intervention, using the same sequence that was employed during the pre-intervention Naming probe with Set 1 stimuli, post-intervention probe was then conducted for the listener and speaker halves of Naming with the original (Set 1) and the novel set of stimuli and the match was not repeated.

Pre- and post-intervention: learn units-to-criterion. Prior to and following the implementation of the listener emersion intervention, data was collected on the number of learn units-to-criterion for a 1,000 learn units across the participants' listener curricular programs. Learn units-to-criterion was calculated prior to and following the intervention in the same exact manner as administered in Experiment I.

Independent Variable

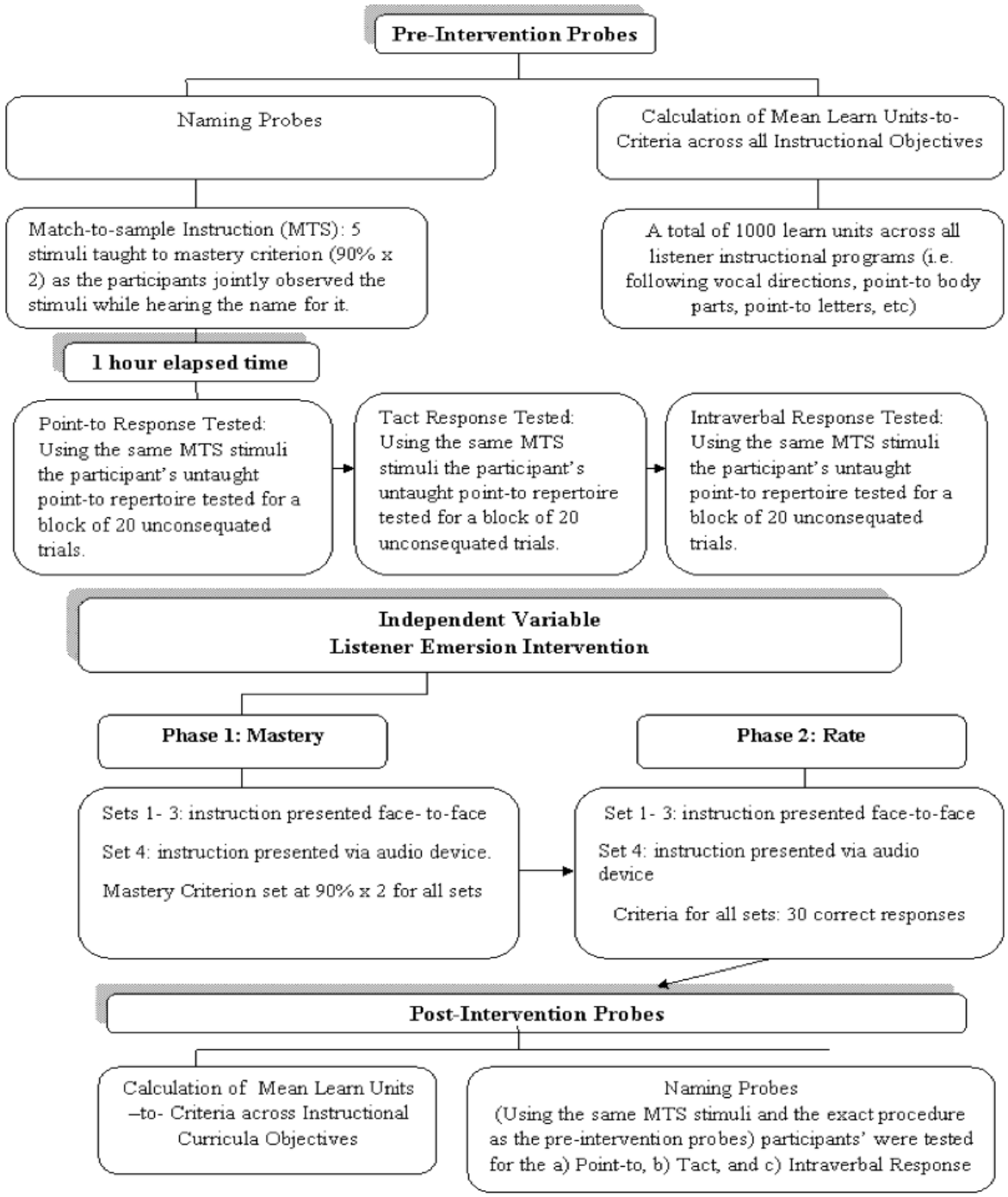
Listener emersion intervention. The independent variable was the mastery of sets of listener commands using the listener emersion intervention developed by Greer, Chavez-Brown, et al. (2005) and the learn unit. The intervention involved teaching listener commands that were divided into four different sets, with each set containing five training commands (See Table 5). In Experiment II, within each set, the listener commands consisted of the same response topographies as those presented in Experiment I. Prior to the onset of Experiment II, Participants D, E, F and G had most of the commands, which were part of the sets in Experiment I, in their repertoire. Therefore, some of the commands used in Experiment II for the listener emersion training sets were different from the ones used in Experiment I. Please refer to the following table for a full description of the commands used under the listener emersion intervention during Experiment II.

Table 5

Description of the sets used in the listener emersion intervention in Experiment II

Set 1	Set 2	Set 3	Set 4
Point to shoulder	Touch the floor	Point to star	Point to knee
Point to heart	Apla dhe	Match green	Match yellow
Match red	Point to cube	Give me cup	Do rea me
Baka, baka, baka	Match blue	Ob la dhe	Point to square
Blow a kiss	Point to neck	Touch your elbow	Point to cheeks

Figure 11. A detailed sequence of the experimental steps that were involved in the pre- and post intervention of Naming probes and the pre- and-post intervention learn units-to-criterion in Experiment II.



Interobserver Agreement

Interobserver agreement was gathered using the TPRA. During the intervention and the probe sessions an independent observer collected data simultaneously and independently at the same time as the experimenter. These second observers were individuals who were teachers and classroom supervisors and held either a M.A. or a Ph.D degree in applied behavior analysis, and had been working at the CABAS® School for a few years. Interobserver agreement was collected for all probe sessions. Interobserver agreement for Participant D was conducted for 100% of the sessions, with a mean agreement of 96% and a range of 72-100%. Interobserver agreement for Participant E was conducted for 100 % of the sessions, with a mean agreement of 99% and a range of 95-100%. Interobserver agreement for Participant F was conducted for 100% of the sessions, with a mean agreement of 99% with a range of 96%-100%. For Participant G interobserver agreement was conducted for 100 % of the sessions, with a mean agreement of 99% and a range of 95-100%. During the intervention, interobserver agreement was conducted for 40% of the total sessions, and the percentage of agreements was 100% for all sessions. Interobserver agreement was calculated for each session by dividing the total number of agreement trials by the total number of agreement plus disagreement trials and multiplying that number by 100%

Results

Pre-Listener Emersion Intervention: Naming Probe Responses for Set 1 Stimuli (Post-Match-to Sample Instruction)

Prior to the listener emersion intervention and following mastery of match-to-sample instruction with Set 1 stimuli, a Naming probe was conducted with the same set. The data shows (Figure 12) that none of the participants acquired the untaught speaker and listener responses for the Naming probe with Set 1 stimuli. Participant D emitted 10/20 correct point-to responses (as a listener), 3/20 correct tact responses and 0/20 correct intraverbal responses. Participant E emitted 0/20 correct point-to responses, 4/20 tact responses and 1/20 correct intraverbal responses. Participant F emitted 0/2 point-to responses, 0/20 tact 0/20 intraverbal responses. Participant G emitted 2/20 correct point-to responses, 1/20 for both tact and the intraverbal responses.

Post-Listener Emersion Intervention: Probe Responses for Naming Emergence to Set 1 and Novel Set Stimuli

Following the implementation of the listener emersion intervention, correct untaught listener and speaker responses increased across all participants to Naming probes conducted for Set 1 stimuli and to a novel set of stimuli. The novel set was used to further demonstrate that Naming had emerged as a result of the intervention. Following the intervention Naming probe data shows that all participants acquired the listener half of Naming to 100% criterion. These results are also summarized in Figure 12.

Participant D, following mastery of the listener emersion intervention, acquired the listener and the speaker half of Naming. That is, he emitted 20/20correct listener responses, 18/20correct tact responses and 18/20 correct intraverbal responses, to the

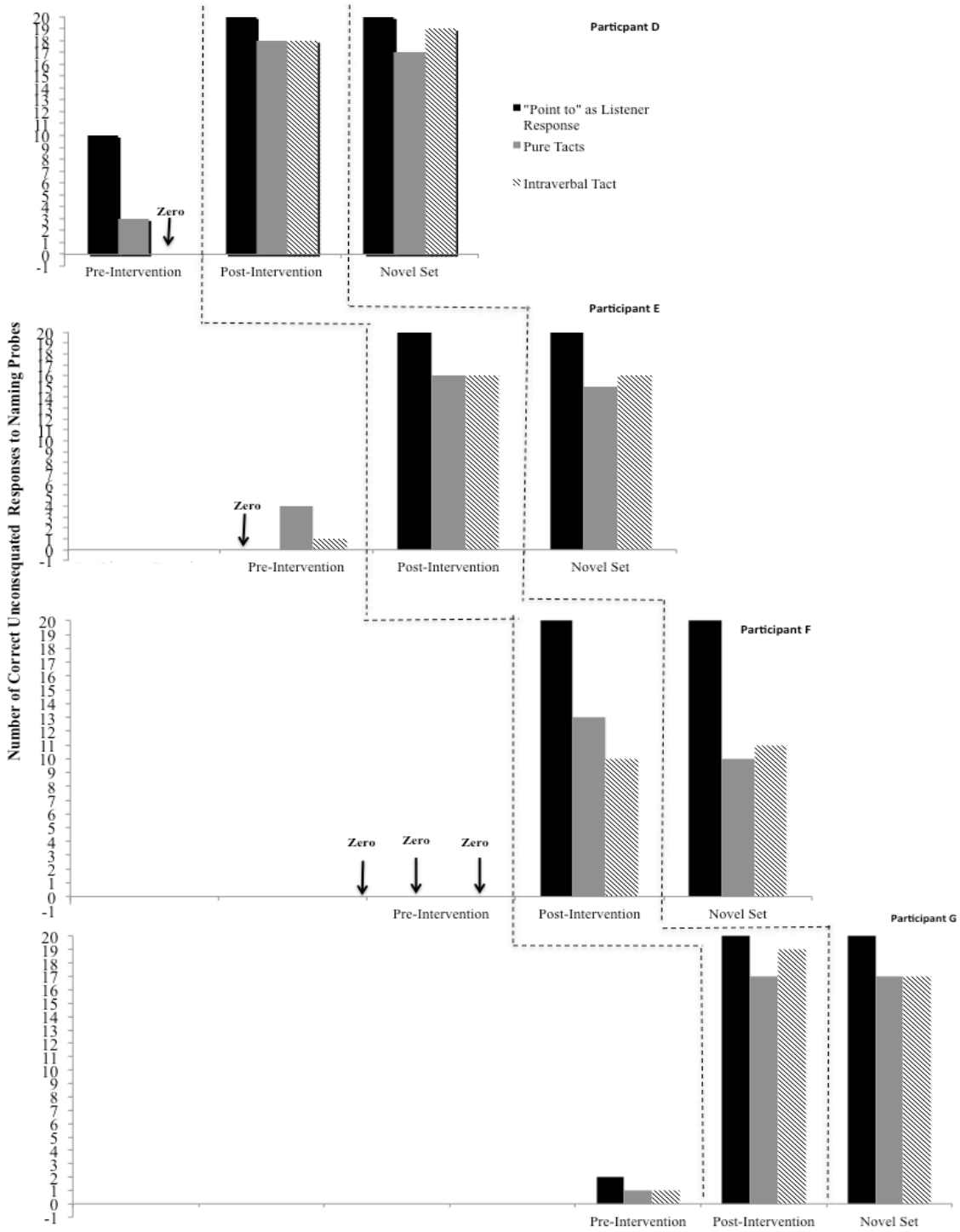
Naming probes for Set 1 stimuli. For the novel set of stimuli, he emitted 20/20 correct listener responses, 17/20 correct tact responses and 19/20 correct intraverbal responses thus further establishing acquisition of the Naming repertoire.

Participant E, following the completion of the listener emersion intervention, demonstrated significant increases in the untaught listener and speaker responses of the Naming Capability. Data for this participant show that his number of correct responses to the listener half of Naming probe were significantly higher than his speaker half of the Naming probes. That is, he emitted 20/20correct listener responses, 16/20correct tact responses, and 16/20 correct intraverbal correct responses, respectively, for Set 1 stimuli. He emitted 20/20 correct listener responses, 15/20 correct tact responses, and 16/20 correct intraverbal responses to the novel set of stimuli.

Naming Probe data for Participant F show that following the listener emersion intervention she also emitted more untaught correct listener responses than untaught correct speaker responses to Set 1 stimuli and the novel set of stimuli. That is, she emitted 20/20 correct listener responses, 13/20correct tact responses, and 10/20correct intraverbal responses respectively, to Set 1 stimuli. For the novel set of stimuli she emitted 20/20 listener responses, 10/20 tact responses and 11/20 intraverbal responses respectively.

Once Participant G completed the listener emersion intervention, Naming probe trials for Set 1 stimuli showed that he emitted the following untaught correct responses: 20/20 listener responses, 17/20 tacts and 19/20 intraverbal responses. For the novel set of stimuli, Participant G emitted the following untaught responses: 20/20 listener responses, 17/20 tact responses and 17/20 intraverbal responses.

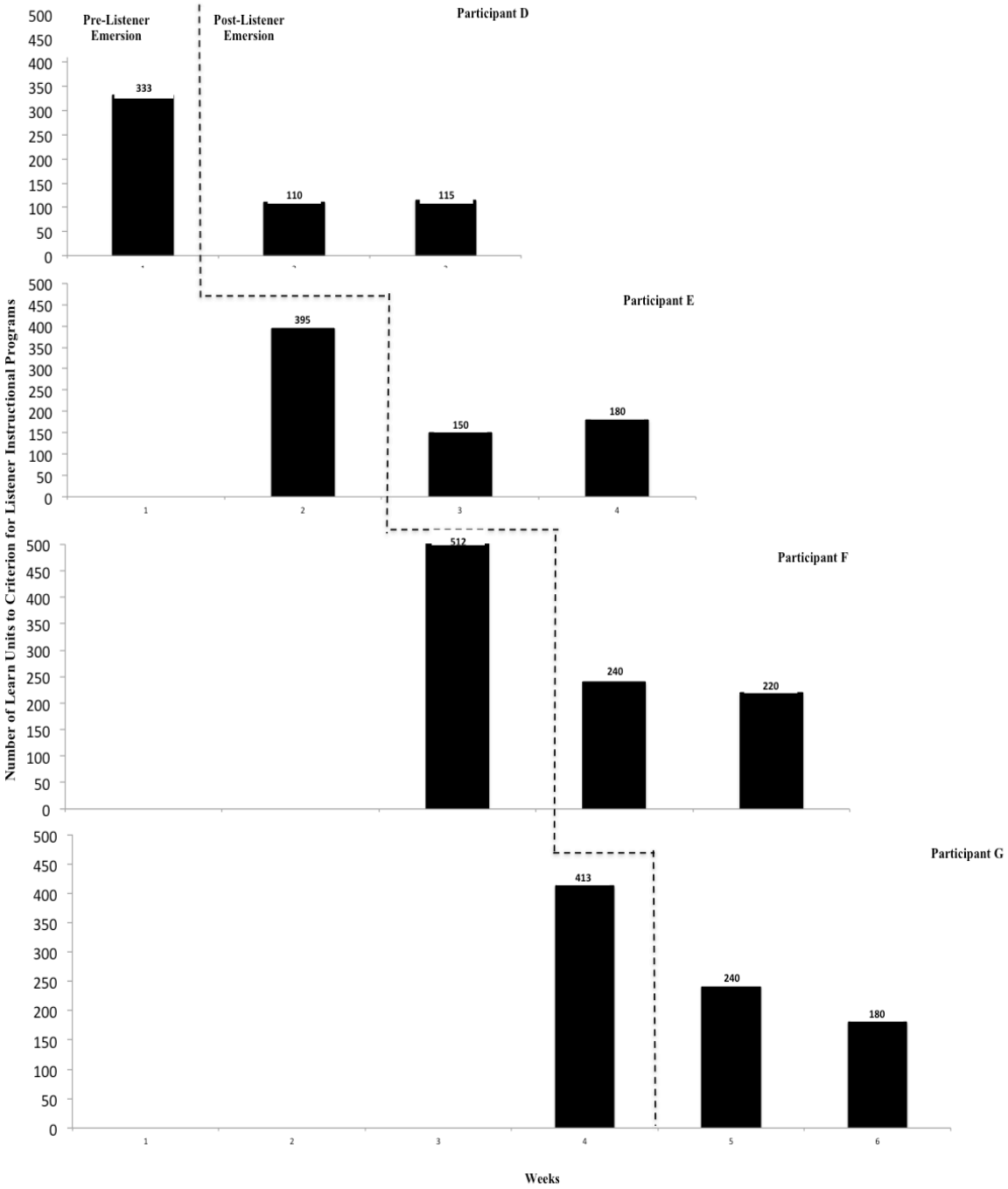
Figure 12. The number of correct responses to the unconsequated Naming probe trials (point-to as a listener), (tacts and intraverbal tacts as speaker) responses for a total of 60 Naming probe opportunities for Participants D, E, F, and G.



Pre and Post-Listener Emersion: Learn Units-to-Criterion (rate of learning)

Figure 13 shows all participants' learn units-to-criterion presented across their listener programs prior to and post-listener emersion protocol. During pre-intervention, Participant D, E, F and G's learn units-to-criterion were at 333, 395, 512, and 413 across their listener program. In the weeks following intervention, Participant D's learn units-to-criterion decreased to 110 and to 115 respectively. Similarly, Participant E's learn units-to-criterion decreased to 150 and 180 respectively. Participant F's learn units-to-criterion decreased to 240 and 220 respectively. Following intervention, Participant G's learn units-to-criterion decreased to 240 during the first week and 180 during the second week.

Figure 13. Shows Participant D, E, F, and G's mean number of learn units required to meet objectives for listener programs prior to and following the listener emersion intervention.



Training sessions under the mastery criterion of the listener emersion intervention. Figure 14 show that all participants acquired the correct responses across the listener emersion training sets through the implementation of a zero-second time delay instructional procedure with learn units. Following 20 learn units of two sessions of zero-second time delay a 1-second time delay was implemented. In the 1-second time delay sessions, Participant D required a total of 32 sessions to complete all four listener emersion sets. He emitted a total of 463 correct responses out of 620 opportunities. His correct responses ranged from 4 to 20. Participant E required 29 sessions to complete all four listener emersion sets and he emitted a total of 404 correct responses out of 580 opportunities. His correct responses ranged from 8 to 20. Participant F required a total of 41 sessions to complete all four sets. She emitted a total of 566 correct responses out of 820 opportunities and her correct responses ranged from 5 to 18. Participant G mastered all four listener emersion training sets in a total of 38 sessions. He emitted a total of 498 correct responses out of 760 opportunities to respond and his correct responses ranged from 4 to 18

Training sessions under the fluency criterion of the listener emersion intervention. In Figure 15, data for Participant D shows that under the fluency instruction of the listener emersion training sets he required 5 sessions for Set 1 and 6 sessions for Set 2 to meet the mastery rate criterion. For Set 3 and 4 he required 4 sessions for each set to meet the mastery rate criterion. Data for Participant E shows that he required 5 sessions for Set 1, 6 sessions for Set 2, 10 sessions for Set 3, and 6 sessions for Set 4 to meet the listener emersion mastery rate criterion. Data shows that under the fluency instruction of the listener emersion training Sets 1-4 Participant F met the

mastery rate criterion in 7 sessions for each one of those sets. Data for Participant G shows that for Set 1 and 4 he met the mastery rate criterion after 6 sessions. For Set 2 and 3 he required a total of 5 sessions to meet the mastery rate criterion.

Figure 14. Shows the number of correct responses emitted under the mastery criterion of the listener emersion intervention for Participants D, E, F, and G.

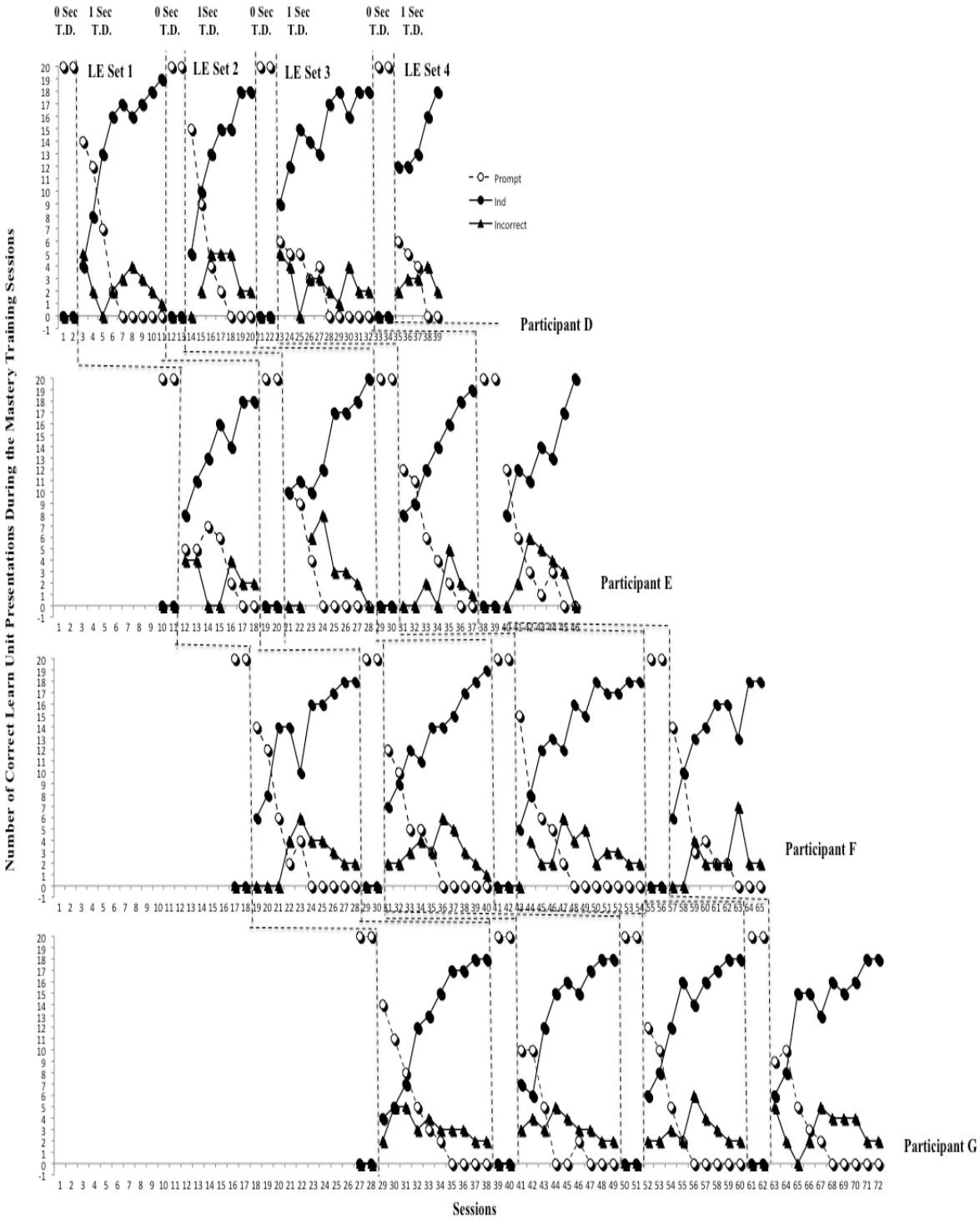
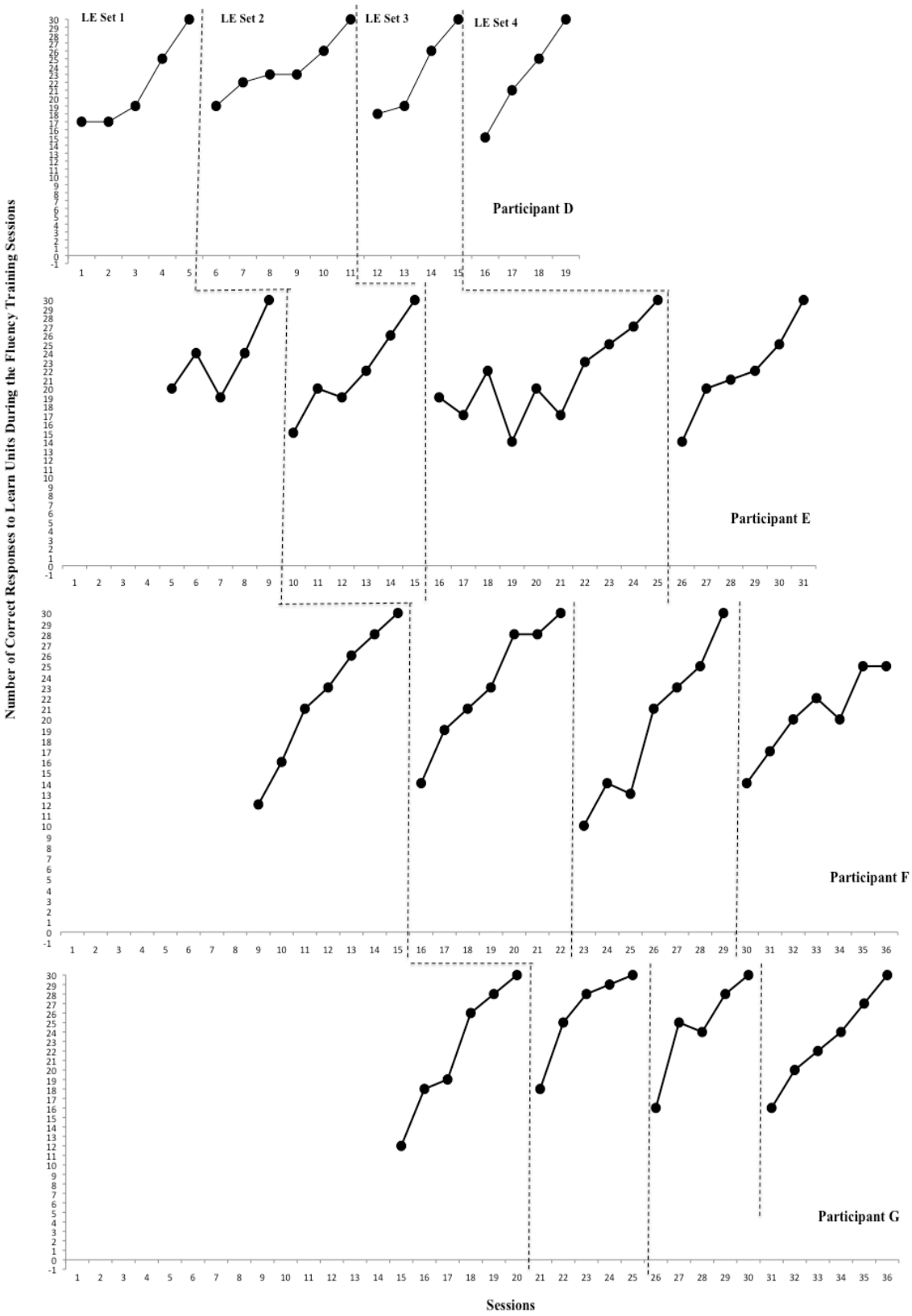


Figure 15. Shows the number of correct responses emitted during the fluency criterion of the listener emersion intervention for Participants D, E, F, and G.



Discussion

The data from Experiment II showed that acquisition of the listener emersion intervention was effective in increasing the rate of learning for all participants as well as in the emergence of Naming for two of the four participants.

For each of these participants, the decrease in learn units-to-criterion, post-listener emersion, showed a big improvement in their rate of learning. Therefore the results from Experiment II replicated the findings from Experiment I for the acquisition of a fluent listener repertoire and accelerated rate of learning. Furthermore, these results supported the results that were concluded in the Greer, Chavez-Brown, et al. (2005) study in which the listener emersion intervention had led to the development of a fluent listener repertoire and facilitated in the decrease of learn units-to-criterion for its participants.

Prior to Experiment II, all participants, when tested for the presence or absence of the Naming capability, showed that they lacked the listener and the speaker components of Naming. Following the mastery of the listener emersion intervention, across all participants the untaught listener half of Naming emerged at 100% accuracy. The higher number of untaught correct listener responses emitted by the participants than the untaught correct speaker responses, demonstrate that acquisition of the listener literacy cusp improved their ability to respond to auditory stimuli. Additionally, the results demonstrate that acquisition of the listener half of Naming prior to the speaker half of Naming is similar to the findings in studies where Naming is the dependent variable (Cahill, 2013; Tullo 2013).

The results from Experiment II showed that upon mastery of each of the fluency training phases of the intervention, increases in correct untaught listener and speaker

responses for Set 1 stimuli emerged for all participants. Data for Participant D and Participant G showed that after mastery of all the four fluency training phases of the intervention they had acquired the untaught speaker and listener halves of Naming for Set 1 stimuli. To further ensure the presence of the Naming capability, a novel set of stimuli was also used post intervention and data showed that Participants D and G both demonstrated Naming for the novel set as well. Although Participants E and F did not respond to the Naming probe trials at 100% accuracy for Set 1 and the novel set of stimuli, they did demonstrate a significant increase in the untaught speaker and listener responses following the intervention. Therefore, the findings from Experiment II provided support for the notion that listener emersion intervention facilitated on the development of the listener and speaker halves of Naming and led to increases in the Naming capability for all participants.

Chapter IV

GENERAL DISCUSSION

The purpose of Experiments I and II was to examine the effects of the listener emersion intervention on the acquisition of a fluent listener repertoire and the induction of the listener and speaker components of the Naming capability with seven 4- to 5-year-old preschool children with autism. In Experiments I and II, following the completion of the listener emersion intervention, the participants' acquisition of fluent listener literacy was measured by calculating the number of learn units required to achieve curricular objectives across their listener programs. The results demonstrated that all of the participants had increased their rate of achievement of instructional curricular objectives following the implementation of the listener emersion intervention.

In Experiment I, probes were also carried out to test for the emergence of the untaught listener component of Naming. Results showed that two of the three participants who did not have the listener half of Naming repertoire at the onset of the study did so after mastery of all the phases of the intervention. Experiment II further measured the effects of the listener emersion intervention on the induction of both the listener and the speaker components of Naming for four participants. Following the completion of the experiment the results demonstrated that the listener emersion intervention was found to be an effective intervention in the induction of the listener component of Naming for all four participants and the speaker component of Naming for two of the four participants. Therefore, experimental evidence from this research further expands on the initial findings regarding the listener emersion intervention (Greer, Chavez-Brown, et al. 2005) and supports the argument that acquisition of true listener responding is indeed a

prerequisite to the development of an advanced listener repertoire, including the development of a more complex verbal repertoire, such as the Naming repertoire.

Research Questions and Major Findings

In Experiments I and II, one of the research questions that I (experimenter) sought to examine was, "Does acquisition of the listener emersion intervention result in a more rapid rate of learning for children with autism who have a limited listener repertoire?" The results from both experiments showed that the rate of learning across instructional curricular objectives had accelerated for all seven participants following the implementation of the listener emersion intervention. The results were significant in that they demonstrated that the intervention had been successful in decreasing each of the participants' learn units-to-criterion. In other words, the participants were immersed in listener programs where all instruction was taught in a manner such that it required the participants to respond only to the vowel-consonant components of the auditory listener instructions until the listener literacy cusp was established. Once listener literacy was established as a verbal developmental cusp, it was clear that it allowed the participants to begin to acquire the ability to respond differentially to different speech sounds. Consequently, by learning to respond only to the acoustic components of speech, the participants' rate of acquisition of new listener operants increased significantly. Thus the efficiency of using the listener emersion intervention where all participants learned more in less time was an important finding. The most prominent decrease in learn units-to-criterion was observed for Participants C and D following the intervention.

In Experiment I, the second research question that the experimenter sought to

answer was, “Will acquisition of the listener emersion intervention also lead to the induction of a more advanced listener repertoire, such as the listener half of Naming?”

Prior to the onset of the intervention, probes conducted for the listener half of Naming using Set 1 stimuli provided data that showed following mastery of match-to-sample for Set 1 stimuli, none of the three participants had the listener half of Naming (emergence of the untaught point-to responses) as an established repertoire. However, once the participants mastered the listener emersion intervention and acquired stimulus control for the listener repertoire, Participants A and C demonstrated the untaught point-to response as the listener component of Naming. Even though Participant B demonstrated a significant increase in his untaught listener responses for Set 1 stimuli, he did not acquire the listener half of Naming. Since Participant B did not acquire the listener half of Naming, an assumption can be made that perhaps more training sets (listener emersion) needed to be implemented until Participant B acquired the listener half of Naming. Furthermore, the data for all three participants showed that acquisition of the untaught point-to listener response was only established following the listener emersion intervention. This occurred because the point-to, as a selection response, was never taught during the match-to-sample sessions, nor reinforced during the probes (tests).

According to the VBDT, and in keeping with the definition criteria set forth by Rosales-Ruiz and Baer (1996) for a developmental cusp, it may be hypothesized that once the listener capability was established, it demonstrated that Participants A and C had acquired a verbal developmental cusp that may have functioned to facilitate in the development of another crucial verbal cusp- the listener half of Naming. In this case these

two participants had learned to come under auditory stimulus control, something that they could not prior to the intervention. This empirical finding further provided evidence of the efficacy of the listener emersion tactic as an intervention to teach the listener half of the Naming repertoire. In other words, for all three participants the listener emersion intervention helped develop the foundational prerequisite that was previously missing, which was to learn to rely on their listener or auditory skills in order to emit the more advanced listener repertoire of the listener half of Naming for Set 1 stimuli. Thus, acquisition of the listener half of Naming for two of the three participants was another major finding of Experiment I. Applied findings from existing research on listener half of Naming (Feliciano 2006; Speckman-Collins et. al. 2007) support the findings in Experiment I.

The results from Experiment I on the emergence of the listener half of Naming led the experimenter, in Experiment II, to further examine and attempt to answer the research question "If the listener emersion intervention can lead to the induction of the listener half of Naming, can it also function to induce the speaker half of Naming?" Prior to the listener emersion intervention, data for all participants in Experiment II showed that none of them had acquired the Naming repertoire post match-to-sample instruction with Set 1 pictures. During the intervention, Naming probe trials conducted with Set 1 pictures showed that the number of untaught correct listener and speaker responses began to emerge for all participants as the participants progressed through the fluency criterion for each of the listener emersion training sets. Following the completion of the listener emersion intervention, Naming emerged for Participants D and G for Set 1 pictures as well as for an additional novel (untaught) set.

The results of Experiment II provided important data to show that a functional relationship had been established between the acquisition of listener emersion intervention and the development of the listener and the speaker components of Naming. In order to better understand the contingent relationship that developed between the acquisition of a fluent listener literacy repertoire and the joining of the untaught listener and speaker responses leading to the development of Naming for Participants D and G and increases in the speaker and listener responses for Participants E and F for the stimuli in Set 1 and the novel set, some possible explanations are discussed in the following paragraphs.

Past research studies using MEI intervention in the induction of Naming has successfully shown that the rapid rotation of instruction across four different topographies (match, point-to, intraverbal, and tact responses) resulted in participants acquiring Naming. In these Naming studies, the researchers proposed that MEI required the participants during the match-to-sample instructions to hear the name of the stimulus, while matching the stimulus. They go on to suggest that this *joint attention* to a stimulus while hearing the name for it, is crucial in providing the conditions that facilitate in the development of Naming (Cahil 2013; Feliciano, 2006; Fiorile, 2007; Greer, Stolfi & Pistoljevic, 2007; Greer & Longano, 2010; Gilic, 2005; Pistoljevic, 2008). For instance Feliciano, (2006) used MEI across match and point repertoires in the induction of the listener half of Naming for children with very limited to no vocal verbal repertoire. In her research, she proposed that MEI besides delivering rapid alternations between match and point-to instruction as a part of the procedure also enforced the participants to "see-hear-do." According to her it was this format of instruction, rather than delivery of separate

instruction in see and do (matching) or hear and do (point-to), that resulted in the establishment of the listener half of Naming for her participants. Likewise, in the listener emersion intervention, instruction was arranged so that rapid alternation of instruction between match, point-to, and one-step directions might have served to mimic the effects of multiple exemplar experiences. For example, when the participants emitted a match-to-sample instruction, they had the opportunity to hear the experimenter tact the name of a stimulus "Match red with red." By jointly observing and hearing the name of the stimulus, the participants had the opportunity to operate as a listener. Therefore, the rapid alternation of instruction, coupled with several exposures to the listener emersion training sets first under the mastery criterion and then under the fluency criterion may have provided sufficient instructional history that resulted in the unification of the listener and the speaker responses to the stimuli in Set 1 and the novel set.

Horne and Lowe (1996) proposed that the source of reinforcement in Naming is the echoic. Research by Longano and Greer (in press) using a stimulus-stimulus pairing procedure, where participants were required to echo the name of the stimulus found that there was an inherent relationship between the emission of echoics, and the acquisition of Naming for their participants. The experimenters go on to suggest that the echoic verbalizations had become a conditioned reinforcer only after the implementation of the stimulus-stimulus pairing, where pairing of the visual and the auditory experiences became a source of reinforcement in the acquisition of Naming (Longano & Greer, in press). In the current study, although data were not collected in Experiment II on the emission of echoics by the participants, anecdotal observations marked prominent changes in the degree of emission of echoics by the participants. As the participants

progressed through the training sets of the listener emersion intervention the experimenter observed that the participants began to echo a response out aloud more frequently than in the initial stages of the listener emersion intervention. In other words, a participant, upon hearing the auditory direction "clap hands" would, while attending to the direction, echo "clap hands," or while attending to a stimulus on the table hear the name of the stimulus ("Point to heart," "Match yellow with yellow") and echo it ("Point to heart" " yellow"). Therefore, it is possible that the vocal instructions, along with the visual stimuli may have facilitated the reinforcement and emission of echoics by the participants and inadvertently set the stage to occasion the emergence of Naming.

In a prior study researcher Chavez-Brown (2005) tested the effects of the auditory matching procedure on the acquisition of the echoic repertoire for two groups of participants. Based on the results of her study, she hypothesized that the intervention procedure, which involved a series of auditory matching instructional sessions, and the echoic response opportunities during the probes may have enacted to simulate multiple exemplar instruction, which resulted in joint stimulus control between the two response classes (auditory matching and the echoic repertoire). In the present study, anecdotal observation of the emission of echoics by the participants, along with the purposeful alternation of the response topographies (e.g. a vocal direction, a matching and point-to direction for a visual stimulus) within the listener emersion training sets may have facilitated in the transfer of control from visual alone to joint auditory and visual control, leading to increases of the Naming capability for all participants. The results of the present study and the results from the Chavez-Brown (2005), Feliciano (2006), and Longano and Greer (in press) studies thus lend support to the hypothesis that, "complex

repertoires such as the development of the listener component of naming and the speaker component of naming is not possible without basic listener literacy" (Greer, Chavez-Brown, et al. 2005, p. 17).

Relevance of the Experimental Findings to Related Literature

Verbal Behavior Development Theory

Previous research within the VBD paradigm has demonstrated that for children with developmental disabilities and autism, the emergence of the listener and speaker capabilities are influenced by each child's unique instructional history and transpire at different rates within each child (Greer & Ross, 2008; Greer & Speckman, 2009). Therefore, in Experiment II, the level of each participant's listener and speaker repertoire see (Table 4) may have functioned to influence the development of the Naming repertoire. While all participants demonstrated the acquisition of the untaught listener half of Naming, differences in the emergence of the untaught speaker half of Naming became apparent when the experimenter probed the untaught speaker responses. The effects of the listener emersion training sessions on the inception of listener literacy as a verbal developmental cusp occurred the fastest for Participant D and G. Once listener literacy was established for Participant D and G this developmental cusp facilitated in joining the listener and the speaker within their skin and developed their ability to come in contact and begin to reliably emit the untaught listener and speaker responses to criterion level for the Naming stimuli. Although Participant E emitted significantly high levels of correct untaught speaker responses to Set 1 and the novel set, he did not

demonstrate the acquisition of Naming following the completion of the intervention. Perhaps repeated exposure to the same stimuli may have resulted in an overall decrease in his levels of responding over time. Also exposure to more listener emersion training sets may have facilitated in the development of Naming for Set 1 and the novel set for Participants E and F.

Conditioned Reinforcement of Observing Responses as a Foundation for Developing Listener Repertoire

The establishment of listener literacy and the subsequent development of a more complex repertoire, such as Naming, is ultimately associated with the acquisition of conditioned reinforcement of observing responses. For instance, from a behavioral perspective, observing responses such as smell, taste, touch, auditory, and visual appear to be critical in representing the initial joining of the listener and the speaker responses Keohane, Delgado and Greer (2009). Skinner, in his analysis of Verbal Behavior (1957), characterized observing responses as operant behavior selected out by its consequences. Cahill (2013), in her unpublished dissertation, tested the effects of observing responses and multiple stimulus control in the development of Naming. In her findings she acknowledged that once conditioned reinforcement for observing or attending to the actions and names (multiple aspects) associated with a single stimulus was established the participants acquired Naming, when prior to the intervention they could not. In other words, she proposes that the foundation for Naming lies in the establishment of a history of reinforcement of auditory and visual observing responses.

Research in VBD paradigm has shown that listening or an auditory discrimination repertoire is crucial in the development of a more complex language repertoire. In one such research Keohane, et al. (2009) hypothesized that for children for whom *observing responses* do not function as conditioned reinforcement fail to develop the correspondence between what they hear and see. Concurrently, they fail to develop the necessary foundations for early verbal language.

Greer, Pistoljevic, et al. (2011) tested the effects of a stimulus-stimulus pairing procedure on the emergence of increased rate of acquisition of listener curricular objectives. Based on the results from their study, the researchers suggest that acquisition of reinforcement for voices as conditioned reinforcers for listening resulted in the participants being able to learn from the auditory directions and acquire listener objectives.

Chavez-Brown (2005), Choi (2012), and Speckman-Collins et al. (2007) showed functional relations between mastery of the auditory matching protocol and the acquisition of a fluent listener repertoire for children missing the listener cusp. Data showed that after the participants completed the auditory match-to-sample instructional training sessions, the participants acquired the untaught listener responses. Based on these empirical results the researchers Chavez-Brown (2005), Choi (2012), and Speckman-Collins et al., (2007) suggest that the auditory matching protocol functioned to condition the auditory words and sounds as reinforcers, which resulted in the development of the untaught listener responses for the participants.

The findings of the studies conducted by Chavez-Brown (2005), Choi (2012), Greer, Pistoljevic, et al. (2011), Longano and Greer (in press), and Speckman-Collins et

al. (2007) have all shown that acquisition of new speaker and listener operants occurred for their participants when conditioned reinforcement for attending to voices was established as a part of their repertoire. The data from these empirical studies further support the theoretical position put forth by the VBDT, that "establishment of the reinforcing value of voices may be a prerequisite for learning to respond to vocal instructions" (Greer, Pistoljevic, et al. 2011, p. 16).

As proposed by the researchers Greer, Pistoljevic, et al. (2011), that listening to or attending to adult voices is essential to the development of a more sound or finer auditory discrimination repertoire. I am (experimenter) proposing that the listener emersion intervention might have indirectly provided a history of reinforcement to effectively condition the auditory directions as reinforcement for listening, which may have resulted in the participants learning to discriminate and respond only to the acoustical properties of the listener commands and performing better across their listener instructional programs. For example, in Experiment II, all four participants' data demonstrated that they did not need to go through all of the training sets before acquiring the listener half of Naming. For Participants D, E, F and G data showed that following completion of phase one of the intervention they had all acquired the listener half of Naming at 100% (criterion). Furthermore, once participants D, E, F and G had completed the listener emersion intervention, data from the probe session conducted for Set 2 stimuli showed that they had all acquired the untaught listener responses at 100%. This indicated that it was only after the participants had mastered the listener emersion intervention that their listener responses increased. Thus it may be inferred that the listener emersion

intervention is an effective teaching tactic that facilitates in the development of a more complex or higher level of learning.

Educational Implications

Skinner's (1957) verbal behavior theory has been key to behavior analysts seeking to understand the importance of the role of the listener, fluent listener repertoires, and the cusp at which the listener and speaker repertoires come to be unified. This theory of verbal behavior is central to the analysis and the development of efficient teaching tactics for children with limited listener and speaker repertoires.

Greer and Ross (2008) describe various empirically tested teaching interventions that have been developed within the VBD paradigm based on Skinner's (1957) verbal behavior. Greer and Ross (2008) emphasize that these teaching procedures have significantly contributed to the field of verbal behavior by providing teaching strategies that have facilitated in the acquisition of listener and speaker repertoires in children missing these skills. The current study contributes to the existing body of literature within the VBD paradigm. The results of this study provide an efficacious teaching procedure that clearly resulted in the emergence of more than one developmental cusp for all seven participants. Once the participants had acquired the listener literacy cusp, this developmental cusp increased the participants' acquisition of the untaught listener half of the Naming cusp (Experiment I and II) and the untaught speaker half of Naming cusp (Experiment II). Thus, the listener emersion intervention provided a key developmental intervention that facilitated the induction of the listener half of Naming and Naming, a crucial repertoire in children for whom these repertoires were not present.

It follows, from an applied perspective, that the combined results from the two experiments have provided evidence of the applicability of a tested intervention that can be implemented in arranging environmental contingencies that make it feasible to accelerate the development of the listener literacy verbal developmental cusp, while concurrently facilitating in the development of the untaught Naming function as a result of acquiring listener behavior.

Limitations and Future Research

Limitations of Experiment II

One of the biggest limitations of Experiment II was that no data were recorded for the echoics emitted by the participants. Anecdotally, the participants were observed to be emitting echoics during the intervention phases, but data were not taken on the cumulative echoic responses emitted by the participants during the listener emersion intervention. A functional relationship between the emergence of echoic behavior and the intervention leading to Naming was not empirically demonstrated.

A second possible limitation of Experiment II pertains to the experimental design that was used. Prior to the implementation of the intervention only one pre-intervention test for the presence of Naming was assessed. A second Naming probe immediately before the onset of the experiment for all participants would have facilitated in strengthening the effects of the independent variable on the emergence of the dependent variable.

Future Research

There were several limitations in the current study. This suggests that future research should further investigate and address these limitations. Prior research by Choi (2012), Greer, Pistoljevic, Cahill et al. (2011), Longano and Greer (in press), Speckman, et al. (2007) all strongly emphasized that the induction of the listener and the speaker components of Naming may have occurred as a result of conditioned reinforcement of voices. Since the current study did not test for this variable, future research should include assessment of voices as conditioned reinforcers prior to and following the completion of each phase of the intervention. In addition, auditory probes of novel one-step directions should be assessed prior to and following listener emersion in order to demonstrate whether if there is a direct functional relationship between the listener emersion intervention and the induction of a advanced listener literacy repertoire.

Conclusion

Skinner (1989) specifically stressed the importance of the role of the listener by stating "In the evolution of a verbal environment nor in the conditioning of speakers and listeners does speaking come first. There must be a listener before there can be a speaker" (p. 86). Greer and Keohane (2005) brought attention to the importance of the listener repertoire by asserting that acquisition of the listener repertoire is a necessary prerequisite in the development of subsequent and more advanced levels of verbal repertoires such as the speaker repertoire, Naming, speaker-as-own-listener, and early reader and writer repertoires.

The results from the two experiments demonstrated a functional relationship

between the listener emersion intervention and the increased rate of acquisition of listener curricular objectives, and the induction of the listener and the speaker components of Naming. Therefore, the data from the current experiments support the Greer et al., (2005) hypothesis that, "complex repertoires such as the development of the listener component of naming and the speaker component of naming is not possible without basic listener literacy" (p. 17).

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Appendix A

Definition of Terms

Behavioral Developmental Cusps

Rosales-Ruiz and Baer (1996) characterized a developmental cusp as:

A cusp is a change that (1) is often difficult, tedious, subtle, or otherwise problematic to accomplish, yet (2) if not made, means little or no further developmental is possible in its realm; but (3) once it is made, a significant set of subsequent development as suddenly becomes easy or otherwise highly probable which (4) brings the cusps crucial to further, more complex, or more refined developmental in a thereby steadily expanding, steadily more interactive realm, (p. 166.)

Greer & Speckman (2009), based on Rosales-Ruiz and Baer's definition (1996), expanded on the definition of behavioral developmental cusps. According to them, a cuspis a change in the capability of the child and is said to have occurred when an individual learns a new skill. As a result of having learned this new skill, the individual can now come into direct contact with new contingencies or experiences that result in new learning opportunities. An example of such a cusp would include a child who has learned to walk. As a result, this child can now learn from direct contact with new contingencies that she could not contact before (Greer & Speckman, 2009).

Comprehensive Application of Behavior Analysis to Schooling (CABAS)

Abehavioral model of schooling that applies principles of behavior and other scientific findings to all individuals involved in the school community: (a) students, (b)

parents, (c) teachers, (d) supervisors, and (e) administrators. The model is continuously modified based on student outcomes and ongoing research. All instruction is measured, and all instructional procedures are derived from scientifically tested procedures that are individualized for each learner (Greer 2002; Greer & Ross 2008).

Conditioned Reinforcers

Conditioned reinforcers are neutral stimuli that function as reinforcers in operant procedures as a result of being paired either incidentally or through systematic instruction with other reinforcers (Donahoe & Palmer 2004; Catania 2007; Greer & Ross 2008). Observing responses such as looking, tasting, listening, smelling and touching are operant responses that are selected out by their consequences that reinforce observation (Keohane, Pereira-Delgado, & Greer 2009; Greer & Speckman 2009). Numerous studies have shown that these responses, when paired with certain conditioned stimuli within their environment, provide a conditioning process for observing responses that have resulted in accelerated learning (Dinsmoor, 1983; Tsai & Greer 2006; Keohane, Luke, & Greer 2008; Keohane et. al. 2009; Pereira-Delgado et al. 2009; Longano & Greer 2010; Greer, Pistoljevic et al. 2010).

Echoic

Echoic behavior is defined as "verbal behavior under the control of verbal stimuli where the response generates a sound-pattern similar to that of the stimulus" (Skinner, 1957, p. 55). That is, echoic behavior can be described as a listener emitting a vocal verbal operant that has point-to-point correspondence (identical similarity) to the vocal

stimulus of another person (Skinner 1957; Greer & Ross 2008). Skinner (1957) points out that parents and teachers can facilitate in the acquisition of a child's verbal repertoire by first establishing an echoic repertoire through reinforcement of the vocal verbal response that resembles the vocal stimulus of the teacher or parents. An example of an echoic behavior would be if a parent or a teacher says "doll," in the presence of a doll and the child, while jointly observing the doll with the parents/teacher and hearing the word "doll," immediately after says "doll." Hearing the child echo "doll," the child's response is then reinforced by the parent/teacher. As seen in this example, and described by Skinner (1957), reinforcement of the echoic behavior can be established this way and further influence the acquisition of a more complex vocal verbal repertoire.

> Skinner (1957), when defining the echoic repertoire, clearly distinguished the difference between echoics and parroting. According to him, parroting is automatic reinforcement and not verbal, as it does not include the presence of a listener, whereas echoics have an effect on a listener, are verbal and have the potential to be reinforced as a mand or a tact by a listener (Greer & Ross 2008).

Listener Emersion Protocol

Is a researched based intervention that was developed by Greer, Chavez-Brown, et al. (2005) to induce basic listener literacy in children who were missing a fluent listener repertoire. The listener emersion protocol is designed to teach children to follow various one-step vocal directions by learning to respond only to the auditory components of the vocal commands. Each of the instructional sets consists of four true directions and one nonsensical direction. The nonsensical directions are inserted into the sets as a way to

further ensure that the children are responding only to the to the acoustic properties of speech. These sets are taught first to mastery criterion (2 consecutive 20 learn unit sessions at 90%) and then to a fluency criterion (rate determined according to the individual student). One of the instructional sets is taped by different adult voices and presented using a tape recorder. The results form the Greer, Chavez-Brown, et al. study showed that once the children has gone through the intensive listener emersion protocol, that acquired a basic listener literacy repertoire.

Listener Literacy

When an individual acquires the capability of responding to the auditory components of speech of others, he/she is defined as a listener. That is, the verbal behavior of the speaker is mediated by the listener (hear and do) (Greer & Ross, 2008). The listener emersion protocol is designed to bring about listener literacy. In other words, "student is immersed in listener programs until the emersion of fluent listener repertoires" (Greer, Chavez-Brown et al., 2005). For example, if a speaker emits the following sentence "sit in your chair," the listener, being governed by the verbal behavior of the speaker, will sit down in his chair. Once pre-listeners acquire basic listener literacy, they can participate at some level in their community (Greer & Ross 2008).

Skinner (1957) points out that the function of the listener repertoire expands the senses of the listener. For example, if a speaker says "it's raining outside," the speaker has mediated an expansion of his senses where the listener, as a result of the speaker's behavior, can "sense" the stimuli without direct contact and decides to take an umbrella before stepping outside.

Listener Behavior

This is a verbal cusp that is acquired once a student has basic listener literacy in their repertoire. According to Greer & Ross (2008), once this stimulus control class is present, the listener repertoire may be expanded. That is, the acquisition of the behavioral developmental cusp for listener literacy allows the child to respond to consonant-vowel sounds of speech and functions as the basis for more complex verbal repertoires, such as the listener component of Naming, including the repertoire of Naming (Greer Chavez-Brown et al., 2005). Keohane, Pereira-Delgado et al., (2009), also point out that that the emergence of early language in children are elementally tied across repertoires of listener such as a child who is able to follow a simple direction, speaker-listener, speaker as own listener, and cross modal capacities for sameness, where the child is able to discriminate between same and different across sensory modalities.

Listener Half of Naming

This is defined as "a key advanced listener repertoire that allows an individual to respond as a listener after incidentally hearing a word spoken by another person" (Greer & Ross 2008, p.110.) For example, a child who has the listener component of Naming, upon hearing the name of the of the stimulus (e.g. dog) while concurrently observing the stimulus (dog), the child can later emit a point-to response or selection response as a listener for the same stimuli without direct instruction. That is, when presented with the vocal direction "Where is the dog?" or "show me the dog," the child can independently point to the dog without directly being taught the stimulus (dog). This learned relation between looking at a stimulus while hearing someone tact the stimulus and responding as

a listener without direct instruction is a crucial repertoire. It is crucial not only because it allows a child to build his/her listener vocabulary through natural verbal occurrences in the environment, but it also serves as a prerequisite for the full Naming repertoire (Greer & Ross 2008).

Learn Unit

The learn unit is a research-based measure of teaching that consists of components of instructional presentation found to predict learning (Albers & Greer, 1991; Greer, 1994; Greer, 2002; Greer & McDonough, 1999, Greer & Ross, 2008& Greer & Speckman 2009). Inaccurate or incomplete instructional presentations using learn units, must include for the student: (1) the need to know (for example a motivating condition); (2) the student attending to the target antecedent stimulus (such as the teacher's instruction); (3) an unambiguous stimulus discriminative (Sd); (4) an opportunity for the student to respond; (5) correct responses immediately followed by reinforcing consequences; and (6) incorrect responses followed by corrections (Albers & Greer, 1991; Selinske, Greer, & Lodhi 1992; Bahadorian, 2000; Keohane, Pereira Delgado & Greer 2009). An example of a learn unit is as follows: after acquiring the student's attention, the teacher or teaching device first presents an antecedent (i.e. "point to your tummy") to which the student responds either correctly (i.e. by pointing to his tummy) or incorrectly (i.e. by pointing to his knee). If the student responds correctly, the consequence for the correct response results in the teacher reinforcing the response by delivering praise and/or prosthetic reinforcement such as edibles. If the student responds incorrectly, the consequence for an incorrect response results in the teacher re-presenting

the antecedent, and requiring the student to emit the correct response, which is not reinforced by the teacher.

Mands

Specify their reinforcers and areunder the control of deprivation or aversive stimulation. That is, it's a verbal operant that is controlled by a need for deprivation (e.g food, water, etc.) and is reinforced only by that item. For example, a child is devoid of water (thirsty) and says "May I have some water please?" the mom replies "yes, sure you can," and gives the water to him. The item manded for may be present (e.g. teacher is holding up the item in front of a student) in view of the person, or absent (e.g. hidden on a shelf). Pure mands have noverbal antecedents and are often characterized as "spontaneous." While impure mands have antecedents (e.g. "What do you want?") (Skinner 1957; Greer & Ross 2008).

Match-to-Sample Responding

This involves listener responses and/or other observing responses that involve the identification of sameness and differences by incorporating stimuli that are either two-dimensional (2D) or three-dimensional (3D) in nature. Match-to-sample (MTS) responding occurs when students are presented with exemplars of the target stimuli (3D/2D) in a field of two other non-target (negative exemplars). The student is required to discriminate between the exemplars presented in front of him by placing the stimulus (3D/2D) corresponding to the target stimulus. Acquisition of a MTS repertoire sets the occasion for the advancement of the listener repertoire (Greer & Ross 2008).

Multiple Exemplar Instruction (MEI)

Is a form of instruction that involves bringing initially independent response topographies (listener/speaker) as responses to a single stimulus such that the single stimulus can evoke both responses, resulting in the emergence of joint control. That is, one stimulus controls several responses (Greer & Ross 2008; Lowenkron 1998). One form of MEI consists of presenting rapid rotation of listener and speaker responses to objects/pictures across different response topographies such as matching, pointing, tacting and intraverbal responses. For example, using MEI to identify the colors red and blue would involve the following instructional sequence: "match red with red," followed by "point to blue," followed by the teacher asking an intraverbal question such as "What color is this?" (while holding up the color red). This would be followed by the teacher presenting a blue stimulus and no vocal antecedent while waiting for the student to tact the blue stimulus. The sequence of MEI instruction continues until the student masters all the response forms (Greer & Ross 2008).

MEI has also been used across written and vocal spelling responses (formerly independent responses) to teach transformation of stimulus function across writing and saying. The manipulation of these independent responses with the same stimulus at some point results in joint stimulus control where both responses can be evoked by that single stimulus. An example of this would be, delivering a learn-unit to a spoken stimulus or a vocal antecedent such as "spell dog". The student responds vocally, spelling "d-o-g." Following receiving a learn unit in this response form. The student then receives another learn unit on another response form (written response topography), such as "write cow," and the student responses by writing "cow." Eventually, the student learns to emit the

untaught response form (either vocally spelling out the word or writing the word) after having learned only one response form. Multiple exemplar establishing operation instruction (MEI EO) is yet another example where manipulating antecedent conditions functioning as establishing operations for both mands and tacts and rotating the speaker responses has been used to teach transformation of establishing operation across mands and tact functions that were never taught directly.

Naming

Horne and Lowe (1996) first used this term to describe Naming as the basic behavioral unit, a higher-order behavior class that combine both the listener and the speaker responses within the organism and upon which all complexities of language are build. Horne and Lowe (1996) point out that the Naming capability usually arises naturally in the course of a child's language development around the age of two.

According to Horne and Lowe (1996), a child acquires Naming by hearing someone tact an object in the environment (dog) while the child (observer) jointly observes the object tacted (dog) by the speaker, thus resulting in the child learning both the listener and the speaker responses without direct reinforcement or instruction. Horne & Lowe (1996) suggest that a child, through learning the listener behavior (the child sees a dog, hears "dog"), then the echoic response (echoes "dog"), learns the bidirectional relations between classes of objects or events and his or her own speaker listener behavior (orients his head to make visual contact with the dog again). Naming, according to them is a "circular relation that includes seeing an object saying its name, hearing one's own utterances and seeing or attending to the object again." Catania (2008) also

defined Naming as a higher order operant and operant class that involves the bidirectional relationship between response topographies

PreListener

Children with autism and other developmental delays who do not respond to the auditory components of speech of others. Since these children are not verbally governed by the vocal verbal behavior of others, they become highly dependent on adults for their day-to-day needs and, responding across instructional programs are emitted based on visual rather than auditory cues. As a result, rate of progress across their instructional goals are slow and they are not able to advance through more complex verbal and cognitive repertoires (Greer & Ross, 2008).

PreSpeaker

Children with autism and other developmental delays who cannot vocally govern the behavior of others by using various topographies of verbal behavior such as vocal speech, signs, electronic communication device, gestural prompt (point-to) and pictures (Greer & Ross, 2008).

Transformation of Stimulus Function

Occurs when two independent responses come under one stimulus control after the relation between the two response functions is established, with as many multiple exemplar instruction as necessary for the individual, such that a single stimulus can evoke joint stimulus control (i.e. evoke both responses). For example, for a child who lacks the

Naming capability, the experiences of hearing someone point to a "car," while saying "car," as the child and the observer jointly observe the car, does not result in the joining or fusion of the listener and speaker responses within the child. The child learns either the listener and not the speaker or the speaker and not the listener response. Thus, each of these operants have to be taught separately using direct instruction. However, as mentioned before, multiple exemplar instruction (Greer, Stolfi, et al., 2005) has been shown to facilitate responding to a stimulus as both listener and speaker leading to the induction of a higher order behavior such as Naming.

Verbal Behavioral Developmental Capability

In the verbal behavioral developmental theory, a capability is described as the "induction of a behavioral developmental cusp which results in a child being able to learn in a way he/she could not before, we identify that as an experientially derived verbal developmental capability and higher order arching operant" (Greer & Speckman, 2009). For example, a pre-listener student who does not make sustained eye contact with visual stimuli may have a difficult time emitting correct match-to-sample repertoire and may not develop correspondence between what he/she sees and what he/she hears, thus hindering his/her progress in the development of more complex skills. However, once the child acquires conditioned reinforcement of observing visual stimuli (3-D and 2-D), the induction of this capability allows the child to learn in ways that he/she could not before. In other words, the child learns to develop correspondence between what he/she sees and hears, which in turn helps the child learn new skills, such as developing listener and

speaker repertoires through natural verbal occurrences in their environment and not through direct instruction.